Engineering Library

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VOL. CXLVII.—No. 3818] LONDON: FRIDAY EVENING, MARCH 15, 1929 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

The Director-General,
India Store Department, Belvedere-road, Lambeth, London, S.E. 1, invites TENDERS for—
SCHEDULE 1.—COPPER TUBE PLATES for Locomotives.
SCHEDULE 2.—BRIDGEWORK, Twelve Spans of 100ft.
SCHEDULE 3.—LOCOMOTIVE BOILERS, with Cylinders and other Equipment.
SCHEDULE 4.—TWO 65ft.-Metre gauge LOCOMOTIVE TURNTABLES.
SCHEDULE 5.—TWENTY-TWO LOCOMOTIVE BOILERS, Superheated.
Tenders due as follows :—
Schedule 1, 5th April, 1929.
Schedules 2 to 4, 9th April, 1929.
Schedule 5, 16th April, 1929.
Forms of Tender available from the above at a fee (which will not be returned) of 5s. for each schedule. 1296

Crown Agents for the COLONIES.
COLONIAL GOVERNMENT APPOINTMENTS.
APPLICATIONS from qualified candidates are INVITED for the following POSTS :—
M/1285.—ENGINEERING DRAUGHTSMAN REQUIRED by the GOVERNMENT of NIGERIA for service in the Harbour Department for two tours each of 12 to 18 months' service and possible extension. Salary £510, rising to £800 a year by annual increments. Free quarters and passages and liberal leave on full salary. Candidates, age 25 to 35, must be experienced in the design of Reinforced Concrete Wharves and other structures, and should have had experience in the offices of a British Port or Harbour Authority.
M/1376.—ASSISTANT ENGINEER REQUIRED by the Railway Department of the FEDERATED MALAY STATES GOVERNMENT for four years' service, with possible extension. Salary 400 dollars, rising to 475 dollars a month by annual increments of 25 dollars a month and thereafter, in the event of the officer being retained, rising to 800 dollars a month, plus a temporary non-pensionable allowance of 10 per cent. for bachelors and 20 per cent. for married men. If at the end of four years' service the officer's services have been continuously satisfactory and he does not remain in the service, he will be paid a bonus of 2850 dollars. The exchange value of the dollar in sterling is at present fixed by the Government at 2s. 4d., but the purchasing power of the dollar in Malaya is considerably less than that of 2s. 4d. in the United Kingdom. No income tax is at present imposed by the Federated Malay States Government. Free passages provided. Candidates, age 23 to 30, preferably unmarried, must have received a good theoretical training, preferably at a University or a College recognised by the Institution of Civil Engineers, and possess a Civil Engineering Degree or obtained such other Diplomas or Distinction in Engineering as the Secretary of State may decide in any particular case, or completed their articles with a civil engineer of good standing and have passed the Examination for Associate Membership of the Institution of Civil Engineers. Should have had at least one year's practical experience of Railway Maintenance, including Bridge Design and Erection, on a British Railway.
M/1332.—ASSISTANT ENGINEER REQUIRED for the Public Works Department of the STRAITS SETTLEMENTS for four years' service, after which, subject to satisfactory service, the officers appointed will be eligible for confirmation in the permanent and pensionable establishment. It is probable that the number of permanent appointments will be sufficient for those officers whose services have been entirely satisfactory, but no guarantee can be given. If at the end of four years' service an officer's services have been entirely satisfactory and he is not offered or declines further employment, he will be paid a bonus of 2850 dollars. Salary 400 dollars a month, rising to 800 dollars by annual increments of 25 dollars, plus a temporary non-pensionable allowance of 10 per cent. for bachelors and 20 per cent. for married men. The exchange value of the dollar in sterling is at present fixed by the Government at 2s. 4d., but its purchasing power in Malaya is considerably less than that of 2s. 4d. in the United Kingdom. No income tax at present imposed by the Straits Settlements Government. Free passages provided. Candidates, age 23 to 26, must have received a good theoretical training, preferably at a University or College recognised by the Institution of Civil Engineers and possess a Civil Engineering Degree or obtain such other Diploma or Distinction in Engineering as the Secretary of State may decide in any particular case or have completed articles with a civil engineer of good standing, and have passed the Examination for Associate Membership of the Institution of Civil Engineers. In addition, candidates must have had at least one year's practical experience of Civil Engineering under a qualified civil engineer.
Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting the reference number against the appointment for which application is made. 1272

Bethnal Green Board of GUARDIANS.
INSTALLATION OF ELECTRIC FANS.
The Guardians invite TENDERS for the INSTALLATION of ELECTRIC FANS in certain parts of their Institution, Waterloo House, Waterloo-road, E. 2, and of their Hospital in Cambridge-road, E. 2, in accordance with a specification which can be inspected at the undermentioned address any weekday (except Saturday), between the hours of 10 a.m. and 1 p.m. and 2 p.m. and 4 p.m.
Copy of the specification and a form of Tender, upon which alone quotations will be received, may be obtained from the undersigned by depositing the sum of £1, which will be returned upon receipt of a bona fide Tender not later than Twelve Noon on Tuesday, 26th March, 1929.
The Guardians do not bind themselves to accept the lowest or any Tender.
By Order,
C. FAULKNER JONES,
Clerk to the Guardians.
Guardians' Administrative Offices,
Bishop's-road, Bethnal Green, E. 2,
8th March, 1929. 1240

FOR SALE.
The Yorkshire Electric Power COMPANY, of 36, Park-place, Leeds, OFFER FOR SALE THREE NISSON HUTS. Overall length 61ft. 4in., width 17ft. 1in., height 10ft. 2in.
These are all in good condition and are at present on site adjoining Ferrybridge Power Station.
Further particulars will be sent on application, and the huts may be seen at any time by appointment at Ferrybridge Power Station, near Knottingley. 1291

The Engineer

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PUBLIC NOTICES

Barry Urban District Council.
NEW WATERWORKS.
CONTRACT C.
The above Council invite TENDERS for the CONSTRUCTION of a CONCRETE SERVICE RESERVOIR of 3 million gallons capacity with Reinforced Concrete Roof, together with SHORT LENGTHS of CAST IRON PIPES.
Forms of Tender, general conditions, specification and schedule of quantities may be obtained from Edward Sandeman, M. Inst. C.E., Consulting Engineer to the Council, 15, Victoria-street, Westminster, S.W. 1, upon payment of Five Guineas, which amount will be refunded upon receipt of a bona fide Tender.
The drawings can be seen at the office of the Water Engineer, Broad-street, Barry, Glam., or by appointment at the office of the Consulting Engineer, 15, Victoria-street, Westminster, S.W. 1.
Sealed Tenders, endorsed "Barry U.D.C. Water : Tender for Contract C, St. Lythan's Reservoir," are to be delivered to the undersigned by Twelve Noon on Monday, 8th April, 1929.
The Council do not bind themselves to accept the lowest or any Tender.
T. B. TORDOFF,
Clerk to the Council.
Council Offices,
Barry, Glam.,
11th March, 1929. 1286

Metropolitan Borough of GREENWICH.
SUPPLY OF ROTARY SCREEN.
The Council of the Metropolitan Borough of Greenwich is prepared to receive TENDERS for the SUPPLY of ONE LARGE ROTARY SCREEN (20ft. long by 6ft. 6in. diameter) for House Refuse, for erection at the Disposal Plant situate at the Tunnel-avenue Depot, East Greenwich.
Manufacturers of the type of screen in question are accordingly invited to apply to the Borough Engineer and Surveyor, Town Hall, Greenwich, S.E. 10, for further particulars of the article required.
The successful tenderer will be required to pay such rates of wages and observe such hours and conditions of labour as are recognised by Associations of Employers and Trade Unions, or settled by Arbitration Court legally established.
Sealed Tenders, endorsed "Tender for Screen," must be addressed to, and reach the undersigned not later than Twelve o'clock Noon on Monday, the 8th April, 1929.
The Council does not bind itself to accept the lowest or any Tender.
FREDERICK J. SIMPSON,
Town Clerk.
Town Hall,
Greenwich,
13th March, 1929. 1301

PUBLIC NOTICES

Metropolitan Water Board.
MAIN FOR THE IMPROVEMENT OF THE SUPPLY TO THE NORTHERN DISTRICT.
The Metropolitan Water Board invite TENDERS for the LAYING and JOINTING of 3757 LIN. YDS. of 20in. MAIN, together with CONNECTIONS and CONTINGENT WORKS, from the Woodford Pumping Station to a point near the Buckhurst Hill Reservoir, in the Urban Districts of Walthamstow, Woodford and Buckhurst Hill, in the County of Essex.
The drawings and contract documents may be inspected without charge at the Offices of the Board, Chief Engineer's Department (Room 201).
Forms of Tender, conditions of contract, specification and bills of quantities, together with drawings and a spare copy of the bills of quantities, may be obtained on and after Monday, 18th March, 1929, from the Chief Engineer, on production of an official receipt for the sum of £10, which must be deposited with the Accountant to the Board and which will be returned on receipt of a bona fide Tender accompanied by all the above-named documents and drawings (with the exception of the spare copy of the bills of quantities, which may be retained by the tenderer). Such payments and applications must be made between the hours of 10 a.m. and 4 p.m. (Saturdays, 10 a.m. and 12 noon). Cheques must be made payable to the Metropolitan Water Board and not to individuals.
Tenders, enclosed in sealed envelopes, addressed to the Clerk of the Board and endorsed "Tender for Main for Improvement of Supply to Northern District," must be delivered at the Offices of the Board (Room 122) not later than 11 a.m. on Monday, 8th April, 1929.
The Board do not bind themselves to accept the lowest or any Tender.
G. F. STRINGER,
Clerk of the Board.
Offices of the Board,
173, Rosebery-avenue, E.C. 1,
11th March, 1929. 1266

City of London Union.
WORKING ENGINEER.
The Guardians of the above Union invite APPLICATIONS for the APPOINTMENT of a NON-RESIDENT WORKING ENGINEER to Take Charge of the whole of the Steam Machinery, Cooking and Hot Water Apparatus, and the Electrical Plant at their Institution, 2a, Bow-road, E. 3. Institution experience desirable. Wages £6 6s. per week, with dinner daily and overalls. Forms of application can be obtained from me up to Saturday, 23rd March, which must be returned not later than first post on Tuesday, 26th March, 1929.
EDWARD R. WOODWARD,
Clerk to the Guardians.
61, Bartholomew-close, E.C. 1,
14th March, 1929. 1297

PUBLIC NOTICES

The Assam-Bengal Railway COMPANY, Limited, is prepared to receive TENDERS for :—
THREE ENGINE TURNTABLES.
Specifications and Tender forms may be obtained at the offices of the Company, Bishopsgate House 80, Bishopsgate, E.C. 2. A fee of £1 1s. is charged, which cannot under any circumstances be returned.
Drawings may be had, at the cost of the tenderer, by application to Messrs. Hodges, Bennett and Co., Ltd., 78, Queen Victoria-street, E.C. 4.
Tenders must be delivered at the Company's Offices not later than Noon on Thursday, the 4th April, 1929.
The Directors do not bind themselves to accept the lowest or any Tender.
By Order of the Board,
THOS. C. BRETT,
Secretary.
12th March, 1929. 1267

Egyptian Government.
APPOINTMENT OF A BOILER INSPECTOR.
APPLICATIONS are INVITED for APPOINTMENT as a BOILER INSPECTOR in the Mechanical Department of the Egyptian State Railways, Telegraph and Telephone Administration.
Applicants must be of British nationality, between 30 and 40 years of age, preferably unmarried, and possess the following qualifications :—
Must have served a regular apprenticeship either with a Railway Company or a firm of Locomotive Builders.
Must be fully qualified to examine and report on the condition of boilers.
Must have had wide experience in the Boiler Building and Repair Work.
Must have had experience in control of men.
In addition to experience in Boiler Work, experience in the Running Dept. of a Railway is necessary.
Salary £E480 per annum (£E1 equals £1 0s. 6d. approximately), free of Egyptian income tax.
The appointment is subject to medical examination.
The selected candidate will be granted a transfer allowance equal to one month's salary for change of residence from England to Egypt and also vice versa.
Period of contract to terminate on 20th September, 1930.
Third-class fares and reasonable out-of-pocket expenses will be paid to applicants who are requested to attend for interview and/or medical examination.
Application and specimen contract forms may be obtained from the
CHIEF INSPECTING ENGINEER,
Egyptian Government,
41, Tothill-street, London, S.W. 1,
to whom they should be returned, with full particulars as to education, qualifications, previous experience, personal references, and COPIES of certificates or testimonials.
Envelopes to be endorsed "Boiler Inspector." 1174

Municipality of Singapore,
STRAITS SETTLEMENTS.
ELECTRICITY DEPARTMENT.
TWO BOILER-HOUSE CHARGE ENGINEERS.
The Municipal Commissioners of Singapore REQUIRE TWO BOILER-HOUSE CHARGE ENGINEERS for service at their New Power Station, the appointments being on the permanent staff of their Electricity Department and being in the first instance upon three years' agreements.
The capacity of the plant first installed was 12,000 kilowatts, with an extension of 10,000 kilowatts now in progress.
Candidates must have had a thorough experience with the Babcock and Wilcox balanced draught system and chain-grate stokers, the Babcock and Wilcox pressure system of oil firing, the care and maintenance of boiler-house instruments and the economics of boiler-house operation. Experience in extra high-tension three-phase generation and steam turbines is desirable. Candidates must have held a similar position for at least two years.
Strict medical examination required.
Salary, 5040 dollars, 5520 dollars, and 6000 dollars per annum respectively for the three years of the agreement, and rising thereafter (if service be continued) in accordance with the Commissioners' salary scheme. The exchange value of the dollar is 2s. 4d. sterling, at which rate the salary for the first year would amount to £588. There is at present no income tax. Free partially furnished quarters provided with an allowance for lighting.
Free passage will be provided with half salary during voyage out. Eight months' leave with full pay is normally granted after four years' service. Liberal Provident Fund.
Applications, stating whether married or single, and giving age and birthplace, with details of education, training and experience, and referring particularly to the qualifications mentioned above, and accompanied by copies (not originals) of testimonials, to be lodged with Messrs. PEIRCE and WILLIAMS, MM. Inst. C.E., 64, Victoria-street, London, S.W. 1, Agents to the Commissioners, not later than Friday, 22nd March, 1929.
Further particulars, if desired, can be obtained from the Agents. 1242

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PUBLIC NOTICES

Government of the Commonwealth of Australia.

TENDER.

LEASE OF COCKATOO ISLAND DOCKYARD.

SHIPBUILDING AND ENGINEERING AND REPAIRING WORKS.

The Government of the Commonwealth of Australia is prepared to receive tenders for the Lease of Cockatoo Island Dockyard as a going concern for a term of 20 years with the option of renewal for a further term not exceeding 10 years.

The Dockyard is situated in the Harbour of Port Jackson, New South Wales, contiguous to the shipping centre of Sydney, and has an approximate area of 37 acres, with extensive deep-water frontage, including extensive wharf and fitting-out accommodation for vessels of the largest size, and is laid out with building slipways, shops, sheds, machines and all appliances and apparatus, tools, &c., necessary for the construction of naval ships and all types of passenger and cargo vessels, together with their Engines, Boilers, and Auxiliaries. The Works are capable of handling all types of General Engineering Work and of turning out all classes of Iron, Steel and Brass Castings, also Heavy and Light Forgings.

GRAVING DOCKS. There are two Graving Docks, the larger of which is 690ft. in length by 88ft., the smaller being 478ft. 3in. by 58ft. 8in. in width.

SHIPYARD. The layout of the Shipyard comprises Mould Loft, Shipwrights' Shop, Platers' Sheds, Forge, Plumbers' and Sheet Ironworkers', Joiners' Shop, Boat-building Shop, Sawmill, Rigging and Sail Lofts, Paint Shop and Galvanising Shops, all equipped with the latest and most modern machinery and appliances capable of dealing with the largest class of work, including all classes of overhaul and repairs.

ENGINE WORKS. The layout of the Engine Works comprises Pattern Shop, Iron, Steel and Brassfoundries, Fitting Shop, Machine Shop, Brass Finishing Shop, Boiler Shop, Coppersmiths' Shop, Testing Shop, Smithery, Electrical Workshop, Tool Room and Laboratory. The shops are fully equipped with first-class machinery and are capable of dealing with new construction and repairs to all types of machinery.

POWER HOUSE. The Power House is complete with Generating Plant supplying the whole of the electric power, light, compressed air and hydraulic pumps required by the Graving Docks and various shops and machinery at the Dockyard.

STORE. A large modern Bulk Store of three floors is available for housing all materials and fittings, and each workshop is equipped with a small issuing store. There are separate Stores for Timber and Iron.

CRANES AND TRAMWAYS. The Wharves, Workshops and Shipbuilding Slipways are well equipped with all necessary Cranes. The Shops, Yards, and the whole of the premises have also a complete system of tramways installed.

OFFICES AND RESIDENCES. Substantially built and well-furnished Offices for the use of Administrative Staff, Clerks, Estimators, Ship, Engine and Electrical Draughtsmen, Foremen, Timekeepers, are available. House accommodation is provided for the use of Manager, Superintendents, Accountant, Caretaker and Police, &c.

FLOATING CRAFT. Floating Craft consists of Floating Workshops, Tugs, Launches, Hopper Barge, Floating Oil Tank, Punts, Landing Stages, &c.

PARTICULARS, together with form of Tender, conditions of Tender, conditions of contract, together with schedule and plans of Dockyard, can be obtained by bona fide tenderers (principals only) at the Office of the High Commissioner, Australia House, Strand, London, W.C. 2; the Prime Minister's Department, Canberra, F.C.T.; or at Cockatoo Island Dockyard, Sydney, N.S.W. A charge of £50 will be made per set of these documents, which sum will be refunded on their return accompanied by a bona fide Tender.

Sealed Tenders, endorsed "Tenders for Lease of Cockatoo Island Dockyard," and addressed to the Official Secretary, High Commissioner's Office, Australia House, Strand, London, W.C. 2; or to the Secretary, Prime Minister's Department, Canberra, F.C.T., Australia, to be lodged at the office of the High Commissioner, London, or of the Prime Minister, Canberra, F.C.T., respectively, not later than Twelve Noon on 30th March, 1929. The highest or any Tender not necessarily accepted.

J. G. McLAREN,
Secretary, Prime Minister's Department.
CANBERRA, F.C.T.

The Lee Conservancy Board.

CLERKS OF WORKS.

The Lee Conservancy Board invite APPLICATIONS for the APPOINTMENT of THREE CLERKS OF WORKS in connection with the Reconstruction of Towing Path Walls and the Building of Sluices between Limehouse and Lee Bridge, London, E. Applicants should state age and experience, and enclose copies of three recent testimonials. Salary, Seven Guineas per week. Only those with experience of Piling, Concrete and Water work, and capable of keeping progress plans need apply. Applications, endorsed "Clerk of Works," must be forwarded so as to reach the undersigned not later than 10 a.m. on March 25th, 1929.

CHARLES N. TWEEN, M.I.C.E.
Lee Conservancy Offices,
Enfield Lock,
Middlesex. 1303

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, ASSISTANT OILFIELDS STOREKEEPER for service in Iraq. Must be unmarried and not over 32 years of age and have had several years' experience of Engineering Materials, Storekeeping Organisation; actual oilfields' experience preferred. Salary according to qualifications.—Apply by letter, giving full particulars, to "STAFF," Turkish Petroleum Company, Ltd., 97, Gresham-street, London, E.C. 2. 1168 A

WANTED, BLAST-FURNACE MANAGER, to Take Control of Blast-furnace Plant for the production of High-grade Foundry Iron. Must be fully conversant with modern methods of manufacture and grading. Excellent opportunity for energetic man anxious to improve position. State age, experience, and salary required.—Address, 1209, The Engineer Office. 1209 A

BRIDGE AND ROOF CO. (INDIA), LIMITED.
WANTED, by the Above, for Calcutta, a GENERAL MANAGER. Must be a first-class designer with up-to-date knowledge of Bridgework practice and with actual Works experience. Commencing salary the equivalent of £1800 per annum plus a commission on profits, with excellent prospects for the right type of man. Age about 35 and not to exceed 40.—Apply, with full particulars of career and photograph, if possible, to the COMPANY, c/o Messrs. Alex. Lawrie and Co., Ltd., 14, St. Mary Axe, London, E.C. 3. 1280 A

WANTED by Large Oil Coy. for Far East, ENGINEER, with College Diploma or Degree, Civil or Mechanical, but with practical experience Mechanical and/or Constructional Work, age 23/30, single. Starting salary £500 per annum.—Write, Box W. B. L., c/o Davies and Co., 95, Bishopsgate, London, E.C. 2. 1243 A

A REPRESENTATIVE is REQUIRED for Yorkshire and Lancashire, North Wales, and Midland Counties, for Engineering and Foundry Works. One who has been connected with the General Engineering and Colliery requirements of these Districts.

Must be good Mechanical Engineer, with ability for increasing present productions and influencing business.

Address, with full particulars of experience, references, and salary required, 1300, The Engineer Office. 1300 A

ARNOLD BOOKS

THE ECONOMICS OF RAIL TRANSPORT IN GREAT BRITAIN.

By C. E. R. SHERRINGTON, M.A., A.M. Inst. T., Lecturer on Transport and Secretary of the Railway Research Service, at the London School of Economics. In Two Volumes, obtainable separately.

VOLUME I. History and Development. xii + 285 pages. **12s. 6d.** net.
VOLUME II. Rates and Service. xii + 332 pages. **12s. 6d.** net.

"This is easily the most important work upon railway economics in this country that has appeared for a generation . . . The whole work is a clever and conscientious contribution to the new outlook, and must take rank at the outset as standard in its own field."—SIR JOSIAH STAMP in *The Spectator*.

STEAM POWER.

By W. E. DALBY, F.R.S., M. Inst. C.E., M.I.M.E., Professor of Engineering in the Imperial College of Science and Technology. SECOND EDITION. xvi + 760 pages, 250 diagrams. **25s.** net

PROPERTIES OF STEAM AND THERMO-DYNAMIC THEORY OF TURBINES.

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VOLUME. I. Theory. By OSCAR FABER, D.Sc., M. Inst. C.E., and P. G. BOWIE, A.M. Inst. C.E. SECOND EDITION. xx + 332 pages, 158 diagrams. **14s.** net.

VOLUME II. Practice. By OSCAR FABER, D.Sc., M. Inst. C.E. SECOND IMPRESSION. xii + 246 pages, 89 diagrams. **18s.** net.

LONDON EDWARD ARNOLD & CO. 41 & 43, MADDOX ST., W.

SITUATIONS OPEN (continued)

WANTED, CHIEF MECHANICAL ENGINEER, to act also as WORKS MANAGER for a Contracting Company in the Midlands. Duties include control of contract plant and works drawing-office, machine shops and yards. Salary £500 to £800, depending on experience, age, education, qualifications, &c., which should be stated.—Address, 1277, The Engineer Office. 1277 A

ASST. ENGINEER REQD. for Factory Building Supervision, London; outdoor exp. essential. Also JUNIOR DRAUGHTSMAN, Building, Steelwork Details.—Address, wages, &c., P5649, The Engineer Office. P5649 A

ASSISTANT RESIDENT ENGINEER REQUIRED IMMEDIATELY for Africa, healthy locality; duration engagement 12-18 months.

Experience desirable in supervision Gravity Dams, Hydro-electric Power Plants, Riveted Pipe Lines, also in Railway Surveying.

Applications invited only from energetic men thoroughly fit and willing to rough it.

State age, full particulars of experience, salary required, and send copies of references.
Address, P5622, The Engineer Office. P5622 A

BOILERMAKER REQUIRED for Oilfields in Mesopotamia. Qualifications: good general all-round Boiler Repair Shop training and experience. Able to turn to all sorts of plating work in addition to repairs. Salary according to qualifications.—Will applicants please apply in writing, with full particulars, to TURKISH PETROLEUM COMPANY, Ltd., 97, Gresham-street, London, E.C. 2. 1169 A

CHIEF ENGINEER for Large Manufacturing Company in the West of England. Duties include erection and maintenance of Buildings and Machinery, control of Drawing-office and Machine Shop and of D.C. and A.C. Electric Power Supply. Control experience essential and knowledge of Rubber Works an advantage. Salary £600 to £1000, according to qualifications.—Address, 1250, The Engineer Office. 1250 A

CHIEF ESTIMATOR REQUIRED for Reinforced Concrete. Must have had considerable practical experience and be quick and reliable.—Apply by letter, stating age, experience, and salary required, to INDUSTRIAL CONSTRUCTIONS, 54, Victoria-street, S.W. 1. 1283 A

ENGINEER (CHIEF) REQUIRED for Large Sugar Factory in Central America, to be responsible for Machinery, Buildings, Locomotives, Rolling Stock; operating economically the machinery under his charge, 60 per cent. electrical and internal combustion engines. Must have held similar position in Spanish-speaking country. Drawing-office experience and good knowledge of Foundation Work. Knowledge of Spanish and able to handle Latin-American labour. Age 30 to 40. Three years' agreement. Salary about Eighty Pounds monthly, all found.—Box No. 170, Brown's Advertising Agency, 166, Buchanan-street, Glasgow. 1246 A

ENGINEER (CHIEF) REQUIRED for Sugar Factory in Central America, to be responsible for Machinery, Buildings, Locomotives, Rolling Stock, and operating economically Machinery in his charge. Must have number years similar responsible position in Spanish-speaking country. Drawing-office experience and good knowledge Foundation Work. Knowledge of Spanish essential, and ability to handle Latin-American labour. Age 30 to 40. Three years' agreement. Salary about Sixty Pounds monthly, all found.—Box No. 174, Brown's Advertising Agency, 166, Buchanan-street, Glasgow. 1247 A

ENGINEER, First-class, REQUIRED for Design of Electrical and Wireless Equipment. Salary and prospects good for designer of standing.—Address applications, marked "Confidential," 1285, The Engineer Office. 1285 A

ENGINEER REQUIRED for South America, to Act as Lubricating Oil Salesman. Must have some years' experience, unmarried, knowledge Spanish.—Reply, giving full particulars experience, age, &c., Box M. B., c/o Davies and Co., 95, Bishopsgate-E.C. 2. 1254 A

INVENTOR'S MECHANIC of First-class Standard is WANTED IMMEDIATELY to join the experimental staff of a well-known Firm. Experience in accurate Mechanical Work of such machines as the Cash Register, Typewriter, Addressograph, &c.—Applications, stating details of experience and salary, &c., by letter to Box 458, Frost-Smith Advg. Service, 64, Finsbury-pavement, E.C. 2. P5619 A

LONDON ENGINEERING WORKS REQUIRE LONDON REPRESENTATIVE, able to secure orders for all kinds of Steel Plate Work, Oil Storage Tanks, Chemical Plant, &c., electrically welded and riveted.—Write, stating age, experience and terms, in confidence, Box 464, Sells Advertising Offices, Fleet-street, E.C. 4. 1281 A

SITUATIONS OPEN (continued)

MECHANICAL ENGINEER, First-class, is WANTED by a well-known firm. He must be able to lay out plant for production and to conduct the mass manufacture of a machine similar to the Cash Register, Typewriter, Addressograph, &c. The position will be a good one.—Applications from real live men only, stating age and full details of experience, by letter to Box 456, Frost-Smith Advg. Service, 64, Finsbury Pavement, E.C. 2. P5618 A

PRODUCTION ENGINEER REQUIRED, to Take Charge of Planning and Progress Department of Works near London employing five hundred hands specialising in Domestic Electrical and Mechanical Appliances. Excellent opening for a really first-class keen man with a University Degree and at least five years' experience of similar work in Great Britain.—Address, stating age and experience, 1264, The Engineer Office. 1264 A

REINFORCED CONCRETE ENGINEER REQUIRED IMMEDIATELY by Specialist Reinforced Concrete Engineers in South Africa; junior engineer, must be single, neat, quick draughtsman, must have had experience in Reinforced Concrete Specialist's Office. Salary about £25 per month. Annual increase. Passage paid. Three years' agreement.—Write, giving full details, experience, and reference, to Box 551, Frost-Smith Advg. Service, 64, Finsbury Pavement, E.C. 2. P5637 A

REPRESENTATIVE for London is REQUIRED by well-known Structural Steel Work Manufacturers. Applicants must have engineering experience and possess connection with buyers of constructional steel work.

State age, experience, and fullest details of qualifications for the position.
Address, 1245, The Engineer Office. 1245 A

REQUIRED, ENGINEER, for Oilfield in Burma.
Good general practical mechanical training and electrical experience.
Drawing-office experience a recommendation.
Single man, not over 30.
First agreement three years.
Salary, excluding allowances, but including provident fund, Rupees 3900, Rupees 4550, and Rupees 5200 per annum.
Passage paid. Medical expenses and furnished quarters free.
Reply, giving age, full particulars of experience, and copies of testimonials, to Box Z.R. 669, c/o Deacon's Advertising Agency, Fenchurch-avenue, London, E.C. 3. 1279 A

REQUIRED IMMEDIATELY for London Correspondence Institution, YOUNG MAN as TUTOR in MECHANICAL ENGINEERING SUBJECTS up to B.Sc. standard. Sound theoretical training and some practical experience essential. Permanent whole-time position.—Address, P5628, The Engineer Office. P5628 A

SPECIAL ENGINEER, with Considerable experience in Pulverised Coal Firing and able to make all general and economical calculations as well as business offers, REQUIRED for progressive MANAGING POSITION, to commence his duties very shortly.

Applications in writing, giving full particulars of education, experience, &c., copies of references, photo, and salary required.
Address, P5624, The Engineer Office. P5624 A

TIMBER.—TRAVELLER WANTED, Already Calling on large engineers and similar in London and suburbs, to Sell Packing Case Timber and Softwoods generally, on commission, at competitive prices.—Address, 1289, The Engineer Office. 1289 A

TWO STEEL SALESMEN REQUIRED, to Work districts outside London area for well-known steel firm. Age about 30/35. Salary about £300 per annum. Applicants must state full particulars and details of education and experience. Only those with steel trade experience or knowledge need apply.—Address, P5630, The Engineer Office. P5630 A

WELL-KNOWN FIRM of COMBUSTION SPECIALISTS REQUIRE in the East Coast area a GENTLEMAN having a good connection among architects, heating engineers, &c., as DISTRICT REPRESENTATIVE. Please give fullest particulars.—Address, 1257, The Engineer Office. 1257 A

SITUATIONS OPEN (continued)

WORKS ACCOUNTANT.—WANTED, an ACCOUNTANT, age about 30, for a large Iron and Steel Works manufacturing pig iron and sections of all descriptions. Comprehensive knowledge of up-to-date methods of Costing essential. Applications will be treated in the strictest confidence, and should state full particulars of experience and remuneration required. Address, P5640, The Engineer Office. P5640 A

WORKS MANAGER.—APPLICATIONS are INVITED for the POST of WORKS MANAGER for a large Iron and Steel Works, with first-class experience in the Manufacture of Basic Open-hearth Steel and latest Rolling Mill Practice. Applicants must be capable and keen organisers and administrators. Applications will be treated in strictest confidence, and should state full particulars of experience, age, and remuneration required.—Address, P5639, The Engineer Office. P5639 A

WANTED, First-class JIG and TOOL DESIGNERS. Knowledge of Small Arm Work desirable.—Address, stating age, experience and salary required, 1302, The Engineer Office. 1302 A

WANTED, ENGINEERING DESIGNER. A Man capable of designing machinery.—Address, P5634, The Engineer Office. P5634 A

WANTED IMMEDIATELY, London, Smart JUNIOR DRAUGHTSMEN. Must be used to Furnace Design and Gas Producer Work. Excellent prospects for right men.—Address, stating age, experience, and salary required, 1249, The Engineer Office. 1249 A

WANTED, FIRST-CLASS MECHANICAL DESIGNER, accustomed to Light Structural and Sheet Metal Work; knowledge of Electricity an advantage.—Address, 1299, The Engineer Office. 1299 A

WANTED, Good All-round DRAUGHTSMAN, with experience in small Narrow-gauge and Industrial Locomotives.—THE AVONSIDE ENGINE CO., Ltd., Fishponds, Bristol. 1295 A

WANTED, Smart JUNIOR DRAUGHTSMAN, Preferably with experience in Centrifugal Pumps, for works in South of England.—Address, giving full particulars of experience, age, salary required, 1258, The Engineer Office. 1258 A

CHIEF DRAUGHTSMAN for Commercial Vehicle Manufacturers. Must have wide experience of Chassis and Component Design and have good technical ability.—Address full particulars, age, and salary to 1256, The Engineer Office. 1256 A

DESIGNS ENGINEER, Electrical and Mechanical. Permanent senior post with opportunities for sound engineer with suitable knowledge and experience.—Address, 1284, The Engineer Office. 1284 A

DRAUGHTSMAN and ESTIMATOR (Experienced) REQUIRED for London Firm of Heating and Ventilating Engineers.—Write, stating age, salary, and experience, Box 555, Samson Clarke and Co., Ltd., 57, Mortimer-street, W. 1. 1253 A

DRAUGHTSMAN DESIGNER. Experienced, for Commercial Vehicle and 'Bus Chassis Layout and Design of Components. Permanency, near London. Age, experience, and salary.—Address, 1235, The Engineer Office. 1233 A

DRAUGHTSMAN for Heavy Oil Engines, Land Type.—Address full particulars, age, and salary required, 858, The Engineer Office. 858 A

DRAUGHTSMAN (Not Junior) for Pumping Machinery, Reciprocating and/or Centrifugal.—Address, stating age, experience, salary required, 857, The Engineer Office. 857 A

DRAUGHTSMAN REQUIRED by Firm of General Engineers and Road Vehicle Manufacturers in the Midlands.—Address, stating age, experience, and salary required, 1220, The Engineer Office. 1220 A

DRAUGHTSMAN REQUIRED for the Design of Jigs, Tools and Fixtures in works situated 30 miles from London. Good experience in design of Press Tools most essential.—Address, stating age, experience, and salary required, 1259, The Engineer Office. 1259 A

DRAUGHTSMAN REQUIRED for Westminster office, with experience in Cranes.—Address, stating experience, age, and salary required, 1292, The Engineer Office. 1292 A

DRAUGHTSMAN REQUIRED for Westminster office, with Structural and Mechanical experience, used to Conveying Plants. State age, experience, and salary required.—Address, 1292, The Engineer Office. 1292 A

DRAUGHTSMAN WANTED, Accustomed to Plant Layout and Detail Work.—Address, stating experience and salary required, 1270, The Engineer Office. 1270 A

DRAUGHTSMAN WANTED for Midland Manufacturers. Must be accustomed to the designing of Machine Tools. None others need apply. State age, full experience, and salary.—Address, 1282, The Engineer Office. 1282 A

DRAUGHTSMAN WANTED, Used to Detailing for Cranes and Lifting Appliances.—State age, qualifications and salary required to HENRY J. COLES, Limited, London Crane Works, Derby. 1278 A

DRAUGHTSMAN, with Experience of Power Transformers.—Apply, stating age, experience, and salary required, to MANAGER, Drawing Offices, B.T.H. Co., Ltd., Rugby. 1229 A

FIRST-CLASS DRAUGHTSMAN WANTED AT ONCE. One used to General and Hydraulic Engineering, with knowledge of Instrument Work an advantage. Must be quick and not afraid of work. Only those with the above qualifications need apply. Salary according to ability.—Address, 1255, The Engineer Office. 1255 A

FIRST-CLASS DRAUGHTSMAN REQUIRED, Midland district, used to Design of Modern Electric Cranes and General Lifting Tackle on own responsibility; sound theoretical training essential.—Address 1287, The Engineer Office. 1287 A

JUNIOR DRAUGHTSMAN WANTED by London firm of Refrigerating Engineers. Age, salary, experience; fullest particulars.—Address, 1294, The Engineer Office. 1294 A

MACHINE TOOL DRAUGHTSMAN WANTED for Machine Tool Design. Applications are only invited from men of first-class ability.—Address, "DESIGN," Wm. Porteous and Co., Advertising Agents, Glasgow. P5632 A

METROPOLITAN-VICKERS ELECTRICAL COMPANY, Ltd., Trafford Park, Manchester, REQUIRES a DESIGNING DRAUGHTSMAN for switchgear. Must be neat, quick and accurate and have had experience in the designing of switchgear for all voltages. State training, experience, and salary required.—Apply by letter, addressed to the COMPANY'S EMPLOYMENT DEPARTMENT, marked "Switchgear Draughtsman." 1159 A

SENIOR DRAUGHTSMAN REQUIRED, with Mechanical Engineering Experience and Design of Machinery.—Address, giving age, qualifications, and salary required, 1293, The Engineer Office. 1293 A

For continuation of Small Advertisements see page 4.

A Seven-Day Journal

The English Steel Corporation.

ON Tuesday, the English Steel Corporation was officially registered. The Corporation represents a capital of £8,000,000, and takes over the steel interests of Vickers, Vickers-Armstrongs and Cammell Laird and Co., Ltd., in accordance with the recently announced agreement. It is stated that negotiations are now proceeding to bring under the Corporation's control other iron and steel interests, representing an additional capital of £8,000,000. No official announcement has as yet been made on the subject, but it is believed that these other interests include three firms covering iron and steel construction, smelting, heavy tool manufacturing and shipbuilding. One of the three firms is stated to have a capital of £5,000,000, and is already closely associated in so far as the identity of some of its directors is concerned with the second of the three, a company having a capital of £2,000,000. It would not be very difficult to fit names to two at least of the companies, but, no doubt, within a short time they will be disclosed officially. The Board of the English Steel Corporation has, we learn, now been constituted as follows:—Mr. G. R. T. Taylor (deputy chairman). Gen. Sir J. F. Noel Birch, Commander C. W. Craven, R.N., Mr. W. L. Hichens, Mr. T. L. Taylor, Mr. R. Whitehead. Mr. G. R. T. Taylor has resigned his post as deputy chairman of Vickers-Armstrongs Ltd., but remains a director on the board of that Company. Mr. G. G. Sim has been appointed Deputy chairman of Vickers-Armstrongs Ltd., in place of Mr. Taylor. Commander C. W. Craven has been appointed managing director of the Vickers-Armstrongs' shipyards and works at Barrow-in-Furness and Newcastle.

The British Airships.

IN the course of the debate in the House of Commons on the Air Estimates on Tuesday, the Secretary for Air, Sir Samuel Hoare, gave some information concerning the date of completion of the new British airships R 100 and R 101 and the tests to which they will be put. The vessels, he said, would, as far as he could see, be finally completed some time in the spring or early summer. The shed trials would be finished in the course of the next few weeks, and if they proved satisfactory tests of the airships would be carried out over this country and within reach of its shores. Thereafter the R 101 would be flown to Egypt and then to India. Subsequently she would essay the Atlantic passage to Montreal. Meanwhile other experiments would be made with the R 100. It may here be explained that as the R 100 is fitted with petrol engines, she is not suitable for operation in tropical climates. The R 101 with her heavy oil fuel engines is free from this restriction. Continuing, Sir Samuel stated that no effort, scientific, technical or operational, had been spared to make the airships successful. For the same amount of money and in the same time twenty airships could have been built had the Ministry and the builders been content to follow the system of construction established by the old war-time Zeppelins. They had, however, gone down to bedrock in the matter and might be said almost to have constructed the airships *ab initio*. Neither the time nor the money had been wasted. He thought it could be claimed that in the construction of the two airships we were to-day far ahead of any country in the world.

Economising Railway Expenditure.

A TOTAL reduction of £2,779,700 on the railway working account during 1928 was reported by Mr. William Whitelaw at the annual meeting of the London and North-Eastern Railway, held in London on Friday, March 8th. The items showing the principal decreases and the amounts of those decreases were, Mr. Whitelaw stated, locomotive running, £1,252,000; maintenance of ways, works and rolling stock, £878,000; traffic expenses, £462,000; and rates and taxes, £250,400. The reduction in the expenditure on locomotive running and traffic expenses had been brought about by economies in wages, coal and other charges. The expenditure on locomotive fuel had fallen, as compared with 1927, by about £969,000. That reduction could not be entirely ascribed to the decreased purchase price of the fuel, but was in fact the result of a lessened consumption per engine mile. The improved and more economical types of engine gradually brought into service since the amalgamation were beginning to show an effect on the annual fuel bill, and credit had also to be given to the enginemen, who by careful driving and firing had assisted in securing economics. Continuing, Mr. Whitelaw stated that very marked economy had resulted during the past year from the reorganisation and improvement of the company's rolling stock shops, and that great progress had been made with the standardisation of the locomotive stock. Continued attention was being given to a reduction in the cost of building and repairing carriages. There was less to look forward to in the economical construction of wagons, for the improvements already made had reduced the cost very considerably. A 12-ton open goods wagon could now be assembled in twelve minutes at a wage cost of 19s., as compared with a cost of 62s. previously. Before the next meeting it was hoped that a locomotive fitted with a high-pressure water-tube boiler and a heavy-oil electric locomotive, both of which were now under construction, would have been tested.

A Wireless and Gramophone Combine.

IN the course of his address at the ordinary general meeting of the Marconi International Marine Communication Company, Ltd., which was held on Monday last, Mr. F. G. Kellaway made reference to the recent announcement concerning the taking over of the Marconiphone Company's business by the Gramophone Company. Under the new agreement, the Marconi Wireless Company would no longer be directly concerned with wireless in its application to the entertainment and educational fields. In the future it would be able, as a part of the great wireless and cable combine, to confine its activities to research and invention in wireless matters generally, to its Chelmsford manufacturing business, and to the development of its traffic services. These, Mr. Kellaway said, were the three great branches of wireless work for which the Marconi undertaking was pre-eminently qualified. He felt certain that even greater progress would be made than in the past in these three directions. On the other hand, the Association of the Marconiphone retail business in broadcast receptions and in the applications of wireless for entertainment and educational purposes, with such a powerful undertaking as the Gramophone Company, would undoubtedly give that business increased possibilities. The arrangements which had been made were such as would increase the volume of employment and would strengthen the technical resources of the Marconi Company. Speaking of the part to be played by the Marconi International Marine Communication Company, Ltd., in the new wireless and cable merger, Mr. Kellaway pointed out that the company would not be affected by this combine, and it would continue to operate as an independent company licensed by Marconi's Wireless Telegraph Company, Ltd., for the exploitation of wireless on board ships.

"Grid" Contracts.

IN connection with the South-East England, Central England, and North-West England Electricity schemes, contracts amounting to approximately £3,250,000 for work have just been allotted by the Central Electricity Board. For the South-East England scheme orders have been placed for 66 kV and other cables with British Insulated Cables, Ltd., Callenders Cable and Construction Company, Ltd., and Pirelli-General Cables Works, Ltd., whilst the British Thomson-Houston Company has secured a contract for 66 kV switchgear in the London area. For the Central England scheme Balfour, Beatty and Co., Ltd., have been awarded a contract for 132 kV transmission lines, and the General Electric Company a contract for 132 kV outdoor switchgear. A contract for 132 kV overhead lines for the North-West England and North Wales scheme has been placed with the Foundation Company, Ltd. Another announcement made by the Central Electricity Board is that consequent on the resignation of Sir John Brooke from the position of secretary, the Board has appointed Mr. Richard Hodding Fox, its present solicitor, to be secretary and solicitor to the Board. Sir John Brooke was formerly secretary to the Minister of Transport, a post which he occupied when the Ministry introduced into Parliament the Bill which ultimately became the Electricity (Supply) Act, 1926. This Act provided for the creation of the Central Electricity Board, and since the inception of the Board Sir John has held the position of its secretary. He is now leaving on appointment as an Electricity Commissioner.

The New White Star Liner.

IN the course of his reply to the toast of "Shipbuilding and Engineering Industries and the Institute of Marine Engineers," which was proposed by the Prince of Wales at the annual dinner of the Institute, held at Guildhall on Thursday evening, March 7th, Lord Kylsant made an interesting reference to the propelling machinery of the new White Star liner. He reminded those present that the new 1000ft. liner now under construction at Harland and Wolff's Belfast Yard would be electrically propelled. The question of whether the machinery for developing the necessary power would be steam, turbine or oil-engine driven, Lord Kylsant went on to say, had been receiving long and anxious consideration. Everything indicated the probability that internal-combustion engines would be best adapted to produce the enormous electrical power which would be necessary to propel so large a vessel at a high speed. The fact that it might be possible to instal an oil-electric drive constituted a further remarkable development in marine engineering. It was inevitable, he thought, that the progress of events should oblige shipowners to adopt the latest type of machinery in their new vessels, and to take the fullest possible advantage of marine engineering achievement. The march of progress could not be arrested, and it would be necessary to keep pace with it if the British Mercantile Marine was to maintain its pre-eminent position. In the earlier part of his speech Lord Kylsant referred to the large tonnage output of 1928, which was greater than that in any year since 1921. The proportion of British-built tonnage, which was 60 per cent. of the world's output before the war, had fallen back after the war, but in recent years it had steadily increased, and had now reached 54 per cent.

A Proposed Severn Bridge.

WITHIN the last few days efforts have been made to secure the support of local authorities and other important interests in South Wales and the West of England, for a scheme to bridge the Severn some ten miles north-west of Bristol. The site selected is that between Beachley, near Chepstow, and Austcliff, on the Gloucestershire side of the river. At the point chosen the river is nearly a mile and a-quarter wide, and it is estimated that the cost of the bridge, which would be two miles long, would be about five million pounds. The preliminary arrangements for a conference of local authorities to be held at Chepstow on April 6th, are now being made by Mr. Fothergill Evans, who is the clerk to the Chepstow Urban District Council. The scheme has been submitted to the Cardiff City Council, and it is hoped that the response to the appeal for support will be such as will enable the promoters to go forward with the scheme and lay it before the Ministry of Transport. The construction of a road bridge at this part of the river was considered in 1923, but the question was then deferred pending an inquiry which was made in connection with the Severn barrage scheme. Now that the barrage scheme is for several reasons, it is understood, not be recommended, it is felt that the construction of a road bridge should again be taken up. The bridge would facilitate road transport between South Wales and the Western and Southern Counties of England, and would appreciably reduce the cost of the present long journeys which have to be made *vid* Gloucester.

The Co-ordination of Transport Facilities.

SPEAKING at the annual general meeting last week of the Underground Electric Railways Company of London, Lord Ashfield made some interesting remarks on the desirability of co-ordinating the passenger transport facilities in the Metropolis. A mile of tube railway cost, he said, £850,000. A mile of tramway cost only £50,000. Omnibuses to give an equivalent service on a mile of roadway cost merely £15,000. The expenses of providing the services also showed a considerable variation. Ninety per cent. of the receipts from omnibuses were required to meet such expenses, 80 per cent. of the receipts from tramways, and only 66 per cent. of the receipts from underground railways. Yet all three forms of transport had to charge practically the same fares, so that the margin of net receipt per passenger was unequal in itself and unequal to the charges to be met out of it. How were all three forms to be kept financially sound and healthy and be placed in a position to avoid fluctuations caused by seasons, habits, irregular expansion and other disturbing causes? The remedy, he said, clearly lay in a scheme of co-ordination. In Paris and Berlin, he added, co-ordination had already given good results. In New York and Chicago negotiations for a unification of interests under private management were now in progress. The movement for co-ordination in London was therefore in the same direction as that which had been found beneficial in other capital cities.

The Melchett-Turner Report.

ON Tuesday, March 12th, the group of employers associated with Lord Melchett and the General Council of the Trades Union Congress met together and formally adopted a joint interim report on the subject of unemployment and the reorganisation of industry. It is pointed out in the report that there are so many basic factors governing the situation that it is only possible to indicate firstly certain specific measures which should be put into immediate operation in order to alleviate the present situation; and secondly, some basic remedies the application of which should be considered in the immediate future. The recommendations made include the suggestion that a Government inquiry should be made into the consolidation of existing pensions and insurance funds, banking and currency problems, and into emigration schemes and their financial support. The proposal is put forward that the unemployment in the mining industry should be considered as a special case and relief measures accelerated. Rationalisation of industry in the widest sense of the term is emphasised, but it is suggested that the changes thereby rendered necessary should be introduced gradually. A further extension of schemes of work of a permanent character is advocated, including the construction of roads, canals, bridges, tunnels; and harbours, and work upon already approved schemes of this type should be hastened. Proposals are also made that all orders for Government and municipal departments should be placed in this country under properly regulated and co-ordinated conditions, and that more liberal trade facilities should be given, enabling home and export credits to be extended. Finally, the conditions governing the entry into and retiring from industry should be carefully considered.

The London Power Company.

No. V.*

THE WILLESDEN POWER STATION.

THE Willesden Power Station, in Acton-lane, was built in 1899 for the Metropolitan Electric Supply Company, Ltd. The object in view was to centralise the supply by taking over the load from the then existing generating stations at Amberley-road, Manchester-square, Rathbone-place, Sardinia-street, and Whitehall, and to create a station which would meet the demands of the future. The site selected had an area of eight acres, and though well situated from many points of view, it had not an abundance of cooling water, so that the station has depended upon cooling towers from the first. The plant started with three vertical compound marine type steam engines direct-coupled to alternators, each of 1500 kW capacity, generating two-phase current at 60 cycles and 500 volts. The pressure was stepped up to 11,000 volts for transmission by twelve air-cooled transformers, each rated at 250 kW. The boiler-house contained sixteen Babcock and Wilcox land-type boilers, each producing 10,000 lb. of steam per hour at 160 lb. pressure, and fitted with Vicars stokers. By the year 1904, another 9000 kW of engine driven machinery had been added, and in that year the first turbine was put down, this being a 3000 kW at 1200 revolutions, Williams–Dick Kerr unit generating at 2750 volts. Another noteworthy event of that period was the installation in 1903 of a powdered fuel plant, in connection with one of the 10,000 lb. John Fraser boilers put down two years earlier. The makers of the powdered fuel plant guaranteed to get an evaporation of 10 lb. of water per pound of coal—which would correspond to a boiler efficiency of about 86 per cent. with the kind of fuel then used—or remove the plant. The plant was removed. In 1910 a more successful development was tried, namely, the generation and transmission of high-tension direct-current on the Thury system. Three motor generating sets were introduced for the supply of current of this kind to the Ironbridge sub-station at Hanwell, a distance of 5½ miles. A full description of this plant is to be found in the "Proceedings" of the Institution of Electrical Engineers, but it may be here mentioned that each generator was designed to supply 100 ampères at a maximum pressure of 5000 volts. At the time the plant was taken out of service, the total transmission pressure of the direct-current had reached about 18,000 volts.

Prior to 1917 all the boilers installed were designed for a working pressure of 165 lb. per square inch. In that year a pair of Babcock and Wilcox boilers, having an evaporative capacity of 35,000 lb. per hour, were put down. These boilers were built for a pressure of 200 lb. per square inch, and a temperature of 500 deg. Fah., and were followed later by six more of similar type. The first three-phase 50-cycle generating machinery at Willesden dates from 1923 only; when two 10,000 kW 3000 revolutions Parsons turbo-alternators, generating at 6600 volts, were put down. At their economical rating of 8000 kW and working with steam at 160 lb. pressure 600 deg. Fah. and a vacuum of 28in., these machines had a consumption of 11·8 lb. per kWH. The turbines were built to use steam eventually at 200 lb. per square inch.

In 1924 a commencement was made with the removal of some of the obsolete plant and its replacement by efficient machinery. To this end two of the reciprocating engines, the whole of the Thury high-tension direct-current plant, eight of the original small boilers, and a part of the switchgear were removed. A new 15,000 kW three-phase fifty-cycle turbo-alternator was installed, together with four Babcock marine type boilers designed for a working pressure of 275 lb. per square inch and a total temperature of 700 deg. Fah. The next year eight more of the old boilers were taken out and replaced by another pair of 50,000 lb. boilers for the higher pressure and temperature. Apart from the installation of a new Spencer coal tippler and bucket elevator no great plant changes were made in 1926, but plans were laid to provide for an expansion of the station so as to render it capable of dealing with an ultimate maximum load of 100,000 kW.

The London Power Company took over the control of the Willesden Station from the Metropolitan Company, on January 1st, 1927, and immediately took steps to give effect to the scheme referred to. A clearance was made of the remaining 10,000 lb. boilers, numbering twelve in all, two Sulzer engines, the original Willans turbine, together with a very large part of the old air-break switchgear and the air-cooled transformers of the two-phase system. Orders were placed for equipment of all kinds, and the work was carried through with such energy that by the end of the year 1928 the generator capacity had been increased by 68,750 kW, the boiler capacity by 556,000 lb. per hour, the transformer capacity by 80,000 kVA, and the cooling tower capacity by 2,560,000 gallons per hour.

The stages by which the Willesden Station has attained its present capacity are shown graphically in Figs. 19 and 20, the former illustrating the growth of the boiler plant and the latter of the generating plant. In each case the successive removals of obsolete equipment are shown as they occurred. The arrangement of the station, as it exists to-day, is illustrated in the plan—Fig. 21. The boiler-house now contains 24 units capable of producing 1,120,000 lb. of steam per hour at normal rating, of which all but two are actually in service. In the turbine room there are eight units of an aggregate rated capacity of 111,750 kW. The condensing plant is served by eight cooling towers capable of cooling altogether some six million gallons of circulating water per hour. The eight new boilers put in by the London Power Company are all of the Babcock and Wilcox marine type, built for a working pressure of 275 lb. and a steam temperature of 675 deg. Fah. Four of them have a rated capacity of 50,000 lb. of steam per hour, while the remaining four are rated at 64,000 lb. per hour. The furnaces are all provided with compartment type chain grate stokers, with forced and induced draught, and with water-cooled furnace walls. In the case of the 64,000 lb. boilers the arches are water-cooled also.

The generating plant installed under the management of the London Power Company comprises a single-cylinder 18,750 kW 1500 revolutions Richardson Westgarth turbine, with English Electric alternator, and two 25,000 kW 1500 revolutions two-cylinder British Thomson-Houston sets with Hick Hargreaves condensing plant. A photograph of one of the latter machines, taken in the station, is reproduced in Fig. 22, and a sectional drawing showing the main features of its design is given in Fig. 23. It is of the impulse type throughout, in accordance with the practice of the British Thomson-Houston Company, but is noteworthy for the large number of stages employed in comparison with the practice of continental designers. For a heat drop of about 420 B.Th.U.'s there are no less than twenty-two stages, eight in the high-pressure cylinder and fourteen in the low-pressure cylinders. This allows of a reasonable blade speed and a good relationship between blade and steam speed, resulting in a high efficiency and good working conditions for the blading.

The high-pressure cylinder casing, together with its diaphragms, is made of cast steel, and the same material is employed for the first half of the low-

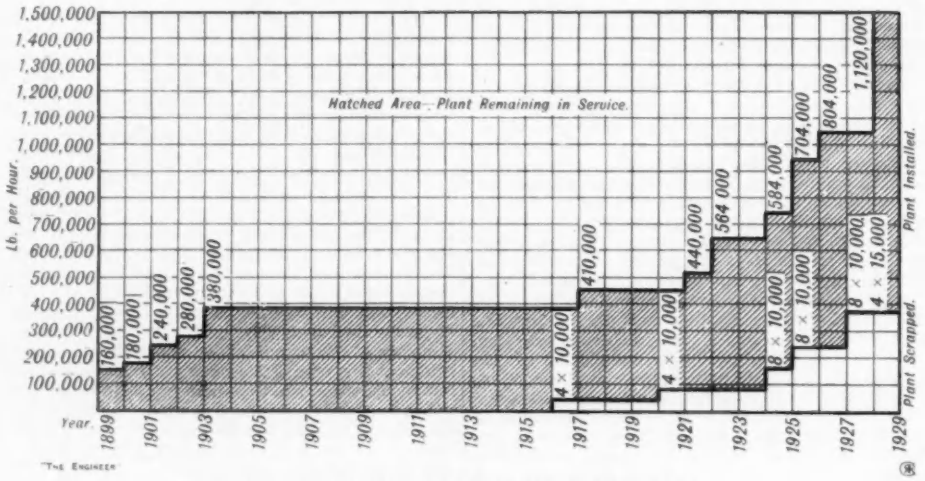


FIG. 19 WILLESDEN—GROWTH OF BOILER PLANT

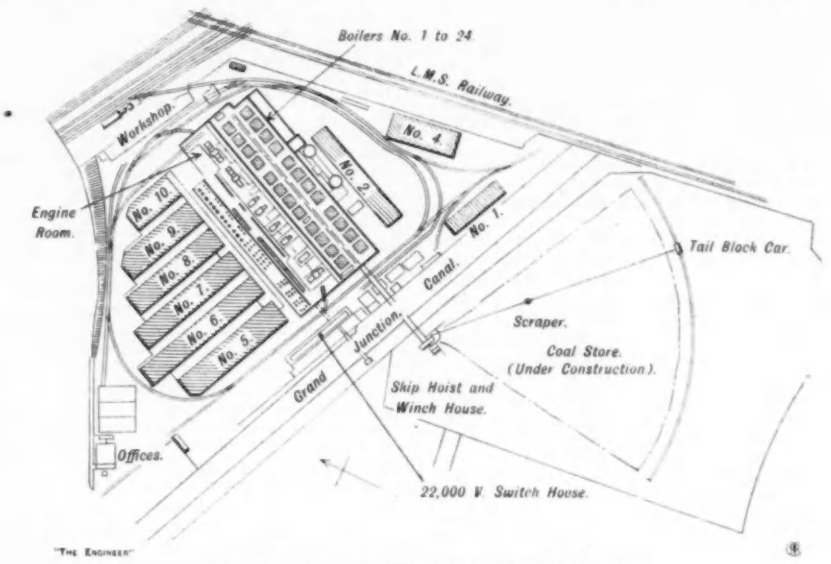


FIG. 21—PLAN OF WILLESDEN POWER STATION

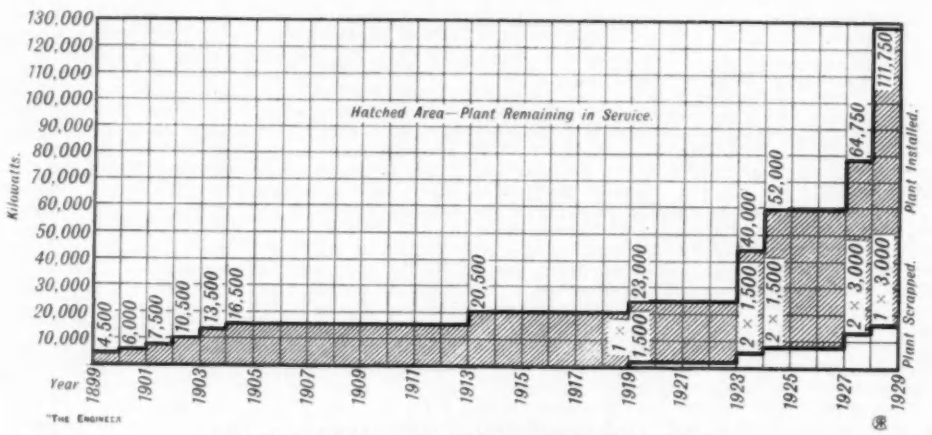


FIG. 20—WILLESDEN—GROWTH OF GENERATING PLANT

* No. IV. appeared March 8th.

pressure cylinder. The shafts of the two rotors are connected by a flexible sleeve and claw coupling, each shaft being located axially with reference to its casing by a multi-collar thrust block. These thrust blocks can be rotated by means of worm gearing so that axial clearances can be adjusted when the turbine is running. Both of the shafts are designed to run below their critical speeds, and to ensure that each remains concentric with its casing under working conditions, each bearing housing is attached to its casing by means of two pads set at 45 deg. to the horizontal and vertical centre lines. Thus when the casing expands radially, sliding can take place between the bearing and casing pads, allowing the shaft to maintain its position relative to the axis of the casing. A somewhat similar arrangement maintains the alignment of the high and low-pressure casings under temperature changes. The low-pressure cylinder is anchored at the foot of the exhaust opening, which rests on soleplates concreted solidly into the foundations. The casing is free to expand in the direction of the high-pressure cylinder. The bearing housing between the two cylinders is free to slide on a soleplate, as is also the high-pressure end bearing. The high-pressure cylinder, being carried on the two bearing housings, is also free to move longitudinally under expansion.

The shafts are of high-grade carbon steel, and, as has been mentioned, do not run through their critical speed. The wheels are all pressed on to the shafts and are pin-bushed to ensure tightness under temperature and centrifugal stresses. The first and last wheels of each rotor are provided with grooves to take balancing weights, and perfect balance under running conditions is ensured by the practice of the makers of adjusting every rotor on a special dynamic balancing machine. The shaft glands consist of segmental metal packing rings with fins. The segments are held in position towards the shaft by flat springs and are sealed with steam, the space next to the outer ring being maintained at a pressure slightly above that of the atmosphere. The fins engage with grooves in the sleeves on the shaft, so as to obtain the maximum wire-drawing effect on the packing steam. The high-pressure running blades are of steel. The first two and the last two wheels of the low-pressure cylinder are also fitted with steel blades, the intermediate wheels of this cylinder having bronze blading. All blades are shrouded, steel shrouding being used for the first twelve wheels of the turbine, and bronze for the remaining ten. The central openings in the diaphragms are fitted with yielding labyrinth packings closely embracing the wheel bosses on the shaft. The packings consist of substantial internally grooved segmental rings fitted into T-shaped grooves in the diaphragms. The bore of the rings is made initially smaller than the shaft, so that they will wear down to a perfect fit when the turbine has been running a short time. Each segment is backed by a stout leaf spring, and when once bedded down can only move in an outward direction against the opposing spring pressure. The diaphragm nozzles are formed by steel plates cast in position. The nozzles are finished smooth, so as to offer the least possible disturbance to the flow of the steam.

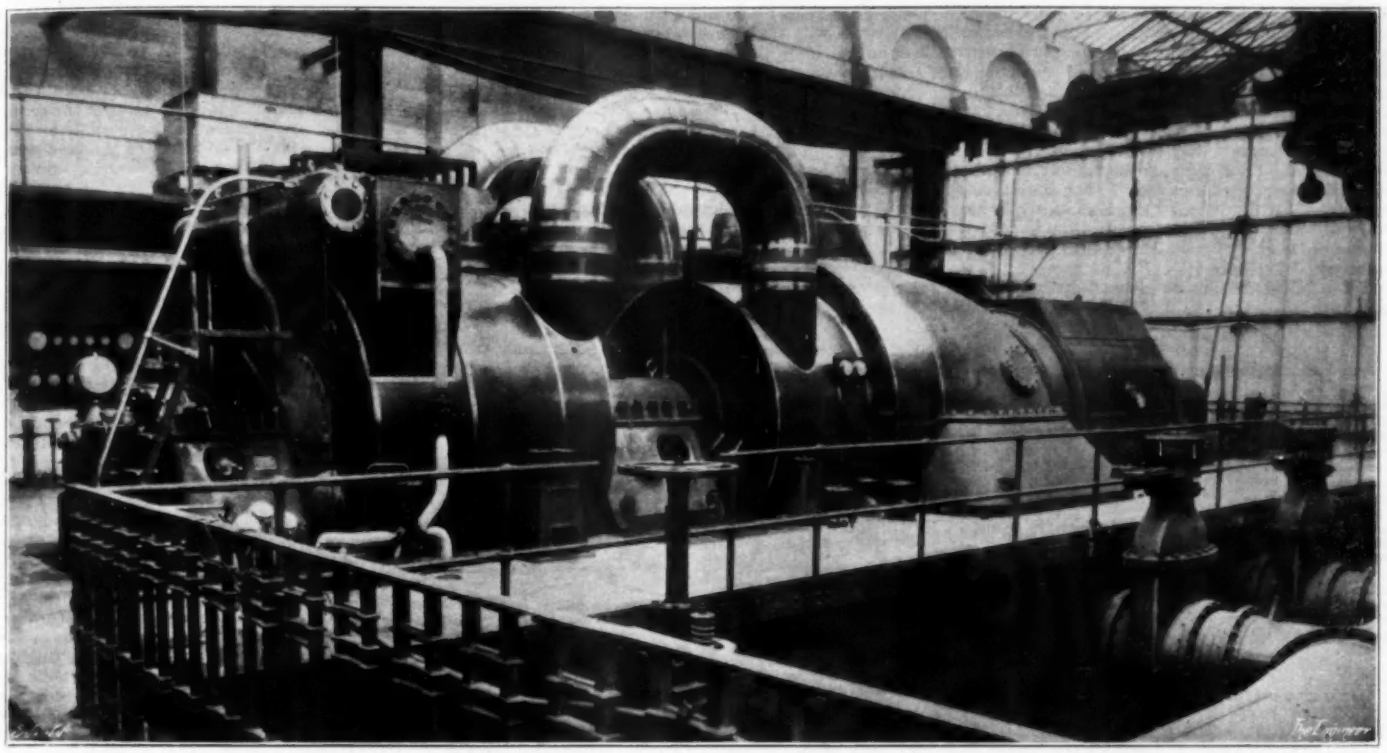


FIG. 22—WILLESDEN 25,000 kW B.T.H. TURBINE

At the steam inlet to the turbine there is a combined stop and emergency valve arranged for operation from the floor level. When the turbine is running, the valve is held open by oil pressure, which is under the control of the emergency governor. Failure of the oil pressure also causes the valve to close. The valve chest containing the controlling valves which adjust the steam supply to the load is cast on to the top half of the steam end casing, thus avoiding any joint between the two. Governing is effected by the movement of a pilot valve which admits oil to the servo-motor actuating the nozzle valve control system. The pilot valve itself is moved by oil pressure, and for this reason the work to be done by the governor is reduced to the absolute minimum. Hence the governing is exceedingly close and sensitive. Oscillograph tests have proved that it is possible by this system of control to open and close twelve nozzle control valves, one after the other, in 1·34 seconds.

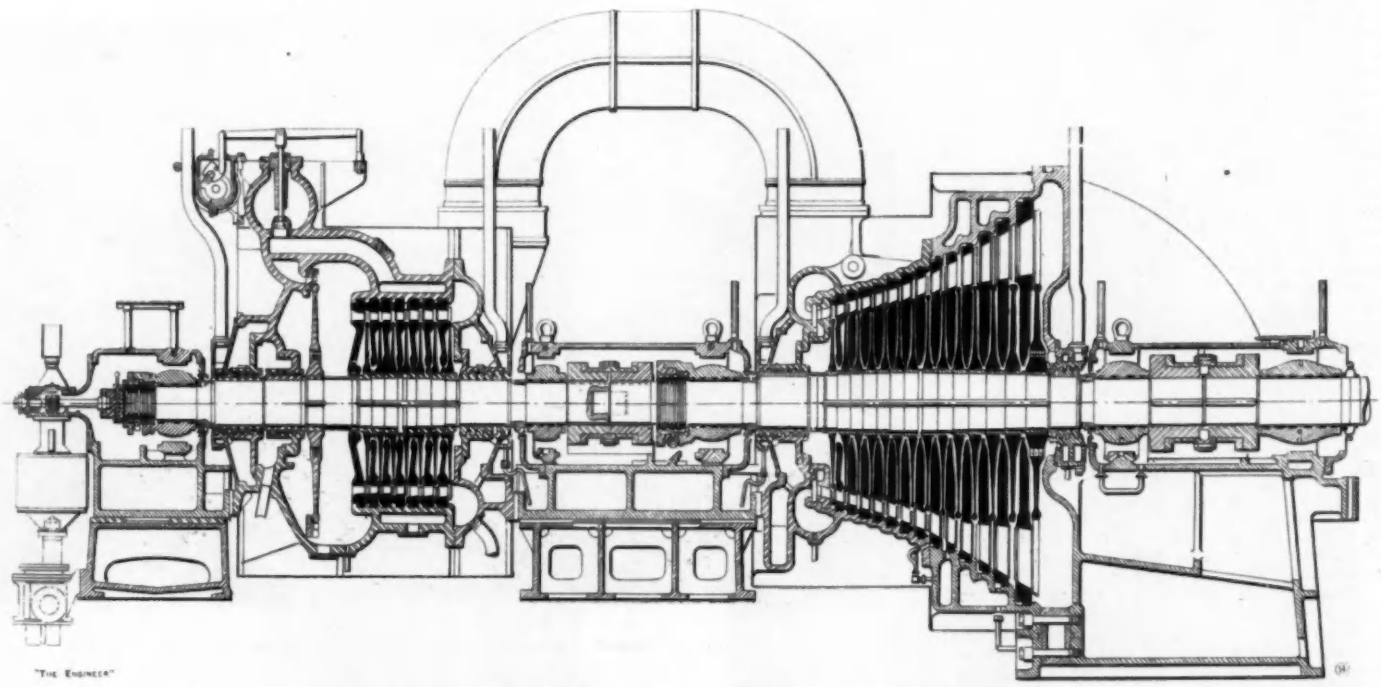


FIG. 23—WILLESDEN—SECTION THROUGH 25,000 kW B.T.H. TURBINE

It will be appreciated that this quickness of response is extremely desirable in two-cylinder turbines, where the volume of the steam within the turbine is already very great. The emergency governor consists of an unbalanced ring held concentrically with the turbine shaft by means of a spring under normal conditions. Excess of speed causes the ring to fly out excentrically with the shaft, when it strikes a trigger, releasing the oil pressure, and thus causing the emergency valve to close.

The alternator rotor consists of a fluted shaft of medium carbon steel, upon which are shrunk the core plates. These are each about 2in. thick, and are still a tight fit on the shaft, even when under the centrifugal running stresses. This form of construction practically eliminates the risk of faulty forgings, yet, nevertheless, the shaft has a central hole bored from end to end, so that the interior may be examined. The rotor is designed to pass through its critical speed at about 60 per cent. of the running speed, as has been the practice of the British Thomson-Houston Company for many years. Vibration at the critical speed is purely a question of balance, and when the balancing has been perfected, the critical speed cannot be detected.

In Table XVII. below are given the results of the official tests of one of the 25,000-kW units supplied by the British Thomson-Houston Company, Ltd. The specified steam conditions were :—A steam pressure of 215 lb. per square inch gauge, at the stop valve, and a steam temperature of 650 deg. Fah. At 100 per cent. load the vacuum was to be 28·31in.; at 80 per cent. load, 28·50in.; and at 60 per cent. load, 28·69in. of mercury ; the barometer being at 30in.

TABLE XVII.—*Official Tests of 25,000-kW B.T.H. Turbo-generator at Willesden.*

Test No.	1	2	3	4	5
Duration of test, minutes	60	60	60	60	60
Load, percentage	100	60	80	100	80
Stop valve pressure gauge, pounds per square inch	210	213	213·3	216·15	215·2
Steam temperature, deg. Fah.	652·4	639·6	645·8	645·7	645·0
Vacuum at exhaust flange corrected to 30in. barometer, inches, Hg.	28·356	28·62	28·42	28·28	28·57
Net condensate, pounds per hour	253,935	153,260	198,670	258,680	199,745
Net output, kWH	25,070	14,980	19,590	25,400	19,930
Actual steam consumption under test conditions, lb./kWH	10·129	10·232	10·142	10·185	10·022
Adiabatic heat drop, B.Th.U. per pound	417·63	423·85	419·27	414·92	423·93
Overall efficiency ratio, with alternator at test conditions, per cent.	80·64	78·66	80·21	80·72	80·30
Steam consumption corrected to conditions of guarantee, pounds per kWH	10·163	10·092	10·04	10·152	10·037
Adiabatic heat drop at condition of guarantee, B.Th.U.	415·54	429·53	423·23	415·24	422·7
Overall efficiency ratio under conditions of guarantee, per cent.	80·77	78·68	80·26	80·92	80·4

NOTE.—Heat drop and efficiencies are based on Callendar's tables.

The utmost care was taken to secure accuracy of the tests. Special tanks with weighbridges, the latter being certified as correct before the tests by an inspector of weights and measures, were used for determining the amount of condensate. The electrical output was measured by specially calibrated watt-hour integrating meters, which were re-calibrated by the National Physical Laboratory immediately after the tests. The steam pressure was read by special gauges, checked by a deadweight tester before the trials, and calibrated by the N.P.L. immediately afterwards. A high-reading mercury thermometer, also re-calibrated afterwards by the N.P.L., was used to obtain the stop valve steam temperature. The vacuum was read at two points diagonally opposite each other on the exhaust branch just above the flange, and the barometer readings were taken on a specially calibrated aneroid instrument and checked against the standard mercury barometer at the station. Furthermore, the conditions throughout the trials were maintained as steadily as possible, and as close as possible to the condition of guarantee, so that the minimum of correction had to be applied. It will be noted, on reference to the table, that the results of the check tests Nos. 4 and 5 show remarkably good agreement with the corresponding tests made previously.

(To be continued.)

The Technical Fair at Leipzig.

No. I.

THE Arctic weather which had prevailed over Central Europe for several weeks, with all the disorganisation it caused to traffic by water, road and rail, did not prevent the Leipzig Spring Fair from opening duly on March 3rd, completely equipped and ready for business. Nor did the thick snow and bitter cold in the East of Germany appear to affect the number of visitors, for in spite of the extra train service, many had to travel long hours as "corridor passengers" in order to reach the city in time for the opening. How many have come this year it is impossible yet to say, but the foreign visitors alone numbered 29,390 last year, and they always appear to constitute a very small fraction of the crowds which throng the streets and exhibition halls at Fair times. As to exhibitors, they have fallen to 10,030, in place of the 10,106 who were present last year, but that insignificant decrease is more than compensated for by an increase in the area covered by goods exhibited. Of the exhibitors, it may be said that 8860 are German, the remainder, equivalent to about 11½ per cent. of the total, being distributed over more than a score of nationalities. Great Britain is credited with 60 exhibitors altogether, being surpassed by Czecho-Slovakia, Austria, France, Japan, and Italy in the order named and equalled by Switzerland. More accommodation has been provided this year, notably by the opening of the new Petershof building, six storeys high, covering an entire block and containing nearly 2½ acres of floor space. This building, which is mainly devoted to musical instruments and toys, brings the total number of exhibition buildings in the inner city up to forty-three, though something like twice this number are occupied in one way or another with the business of the General Fair. The Technical Fair, contained in its own grounds of over 135 acres extent, has also a new hall this year, which, with its 95,000 square feet of floor space, makes practically 25 acres of the Fair grounds now occupied by buildings.

Those who have never visited Leipzig may get a good idea of the lay-out of the Technical Fair grounds from the aerial photograph reproduced in Fig. 1. In the foreground will be seen the two masts of the Central German wireless transmitting station. The broad street which appears behind their summits in the photograph is the "Street of the Eighteenth of October." It terminates on the right at one of the Fair entrances, and leads thence, across the Fair grounds, to the imposing monument in commemoration of the "Battle of the Nations," which is beyond the picture on the left. Starting from the entrance referred to, the great building on the right-hand side of the street is Hall No. 9, in which the famous exhibition of the German machine tool makers is held. Another aerial view of this hall, showing its striking façade, is given in Fig. 2, while Fig. 4 gives a general idea of its internal appearance. Opposite the Machine Tool Hall, and on the other side of the road, is seen a much smaller T-shaped building. This is a structure occupied by the exhibits of the Soviet Government. A very large red flag floats over it, and the interior is mostly filled with specimens of furs, feathers, grains, minerals, and other natural products. Just inside the entrance is a great map, to show apparently where concessions may be obtained by those willing to take the risk of developing the resources of that misgoverned country. Continuing along the street, the next building reached on the right-hand side is Hall No. 8, shown separately in Fig. 3. This Hall is now almost entirely filled with textile machinery, humidifiers being fitted to enable the various processes to be demonstrated under favourable conditions. The Swiss makers are very much in evidence, particularly in connection with silk-working machinery. Four British manufacturers have stands, namely, Platt Brothers, Ltd., who show a new design of ring spinning frame ; Brooks and Doxey, Ltd., who show a carding engine ; Vickers (Crayford), Ltd., with a pair of looms ; and Foxwell and Sons, Ltd., with a new machine for printing names or trademarks on the selvedges of cloth.

The large square building in the centre of the Fair Grounds is Hall No. 7, used for the first time last year, when it was occupied by a collection of heavy motor vehicles. It is noteworthy for the high ridge and furrow roof of over 300ft. span, giving excellent lighting without any pillars or obstructions whatever in the whole area covered. The details of the design were fully illustrated in the issue of THE ENGINEER for March 16th, 1928. It is in this hall that the remainder of the British exhibitors at the Technical Fair are to be found. About two-thirds of the floor space are covered by stands of a miscellaneous nature, the majority of which appear to be devoted to apparatus concerning the cooking or preparation of food. In this section, Rose Brothers, Ltd., of Gainsborough, who are regular attendants at Leipzig, demonstrate their caramel making and packing machines in operation, and the Iceland Freezer Company, of Accrington, shows ice-cream machines. The remaining third of the floor is devoted to machine tools, this section constituting a sort of overflow from Hall 9, available also to makers who have no right to exhibit in the latter hall. British machine tools are shown on three stands only, but, fortunately, the exhibits make up in quality for the fewness of their numbers. Alfred Herbert, Ltd., deserves first mention. Last year the firm had a good exhibit, but it was by itself, surrounded by a lot of incongruous apparatus, in another hall, where many visitors must have missed it. This year it has an excellent position and makes a display worthy of it. All the machine tools are shown in operation, the largest being a No. 20 turret lathe. An "Atritor" for pulverising coal is also exhibited, the machine being shown open, so that the interior can be examined. Needless to say, literature printed in German relating to each exhibit was available, and the machines were provided with instruction plates in German. The reputation which Messrs. Herbert have established on the Continent is due, we believe, almost as much to their enterprise in going after the business as to the high quality of their machinery, and their example in both respects may be commended to those who think it impossible to obtain orders in the face of the low labour costs prevalent in many of the European countries. This year the Associated British Machine Tool Makers, Ltd., has a stand for the first time, where milling machines by Parkinson and Archdale, capstan lathes by Ward, a gear grinder by Churchill, and a slotter by Butler are to be seen. The two latter machines are practically without rivals at the Fair. Another unique machine of British manufacture is a vertical automatic lathe by John Ryder and Sons, of Bolton, which occupies a stand to itself. On the whole, British makers of machine tools are creditably, if inadequately, represented, and the appearance of a few of their products at Leipzig will do something to convince foreign buyers returning from the Birmingham Fair, that a British machine tool industry does really exist.

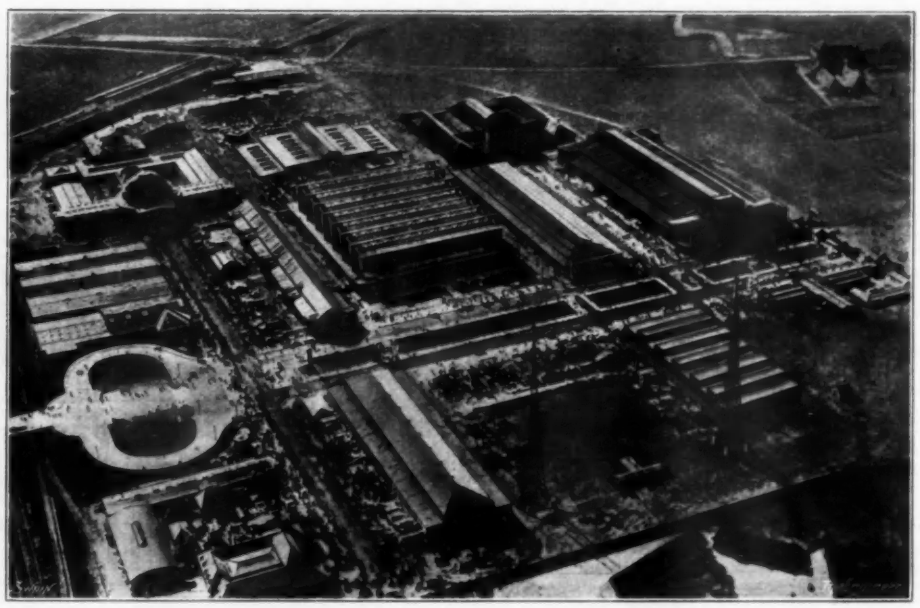


FIG. 1—AERIAL VIEW OF LEIPZIG TECHNICAL FAIR GROUNDS

Next to Hall No. 7 in Fig. 1 will be seen a long narrow building, known as Hall 6. This is almost exclusively given over to apparatus for the wireless industry. Opposite it, in the foreground of the photograph, is Hall No. 21, containing many exhibits of engineering interest. Here is the show of internal

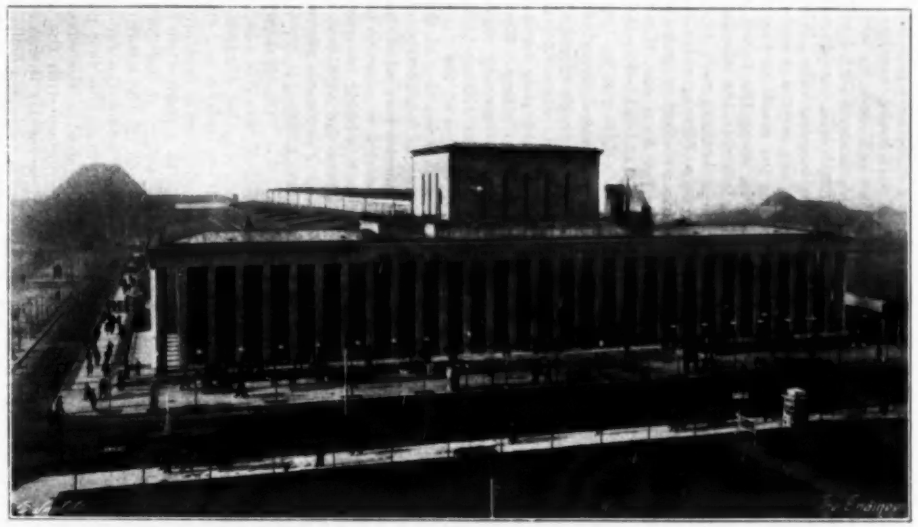


FIG. 2—EXHIBITION HALL NO. 9—MACHINE TOOLS

FIG. 3—EXHIBITION HALL NO. 8—TEXTILE MACHINERY

FIG. 4—INTERIOR OF MACHINE TOOL HALL

FIG. 5—INTERIOR OF HALL NO. 19—BUILDING ACCESSORIES

combustion engines, scores of which are running and making the atmosphere anything but pleasant. The oppressiveness is added to by a number of oil-fired furnaces in operation, though the intense cold on the opening day of the Fair seemed to make the furnaces much more attractive to visitors than they otherwise might have been. There is not much to be said about the numerous Diesel engines on view, except perhaps to comment on a tendency to change the design so as to make the external appearance conform to modern ideas of what is beautiful. Large, smooth, flat surfaces meeting at obtuse angles seem to be coming into vogue in place of rounded ones, the development being apparently akin to that which has resulted in the modern form of bonnets for motor cars. The effect is in general not unpleasing, but it makes the accustomed lines look very old-fashioned. Among such a collection of engines, though it seems invidious to pick out any maker for special mention, a few words may be said about the exhibit of the Maschinenfabrik-Augsburg-Nuremburg. This company, which was the original builder of Diesel engines, shows its latest type of airless injection six-cylinder engine of 280 H.P. Similar engines are built up to 2000 H.P. rating, eight cylinders being used in this case. The stand also contains a model of a double-acting two-cycle engine of 15,000 H.P., suitable for central power stations or marine work. Among so many Diesel engines, steam machinery would seem to have little chance, but it is not entirely absent. Messrs. Wolf, for example, show a locomobile engine, Messrs. Schmidt a model of their indirect heated boiler for very high pressures, while other firms exhibit steam fittings and instruments.

Alongside Hall 21, but on the opposite side of the roadway, are Halls 1, 2, and 3, grouped round a square containing exhibits of road-making and similar machinery. The halls in question are of no particular interest to the engineer, much of the space being devoted to pictures advertising holiday resorts. The Southern Railway has a stand of this kind in Hall 1, the other British railways making a similar demonstration in the so-called "British Section" in the Ring Messhaus.

Crossing the "Street of the Eighteenth of October," we come to Halls 4 and 5, almost touching each other. These are spacious low structures, one filled with baths and heating and cooking appliances, and the other mostly with electric apparatus and fittings. At the end of the road is Hall No. 12, adorned with a large cupola. It contains a miscellaneous collection of material, amongst which ironmongery is prominent, though bicycle fittings, small tools and typewriters are also in considerable evidence. Behind Hall 12 is a curved building, No. 13, with a fine display of shoemaking machinery on the ground floor and shoes, boots and accessories on a floor above. At the side of Hall No. 12 and behind Hall No. 7 is Hall No. 11. This is one of the halls interesting to an engineer, but its contents are so varied that no summary is adequate to describe them. There is quite a number of machine tools, mostly of the wood-working variety, lathes, shapers, portable tools, hand tools, &c. &c. It is a pleasant hall because of its variety, but the reason for so heterogeneous a collection of goods is not obvious. Leaving it, we come to the "Haus der Elektrotechnik" in the corner of the grounds. It is a somewhat imposing building with its great entrance pillars. The central portion is occupied by some of the heavier electrical goods, the Allgemeine Elektricitäts Gesellschaft and the Siemens Company each having very large displays. The side and end galleries contain exhibits of lamps, fittings and such-like apparatus.

The only remaining hall to be noticed is the one known as No. 19, and seen behind the wireless mast in the foreground of Fig. 1. This is a quite new hall, used for the first time this spring. It now houses the Building Materials Exhibition, a much-advertised feature of the present Fair. We give an external view of the building in Fig. 6, from which it will be seen that beauty was not the first consideration of the architect. The design, however, is practical, and the roof construction is interesting, giving a well-lighted interior, as will be seen from Fig. 5. The articles exhibited are mostly bricks, tiles, stones, cement and other things necessary or useful for the building trades. This, it may be said, is almost the only large hall in which there is any partitioning between the stands. The policy of the Fair authorities is to make the general aspect of the halls pleasing, with wide prospects everywhere. An exhibition is for the purpose of exhibiting, not concealing, and wherever the nature of the goods is such that walls and shelves are unnecessary, the stands are open on all sides. If, however, success has been achieved with the interiors—and Fig. 4 shows how great this success can be—one cannot say the same for the external appearances of the buildings. Leaving aside the Machine Tool Hall, the others are either common-place or positively ugly, and no two of them seem to have any right together in the new Fair Ground. This state of affairs is now recognised by the Fair authorities, who are said to be considering the offer of a prize for the best solution of the problem of securing more beauty and harmony of the buildings.

(To be continued.)

Fig. 6 Exhibition Hall No. 19 Building Accessories

Shunting on Railways.

British railway companies pay away each year about £4,000,000 in wages alone on shunting, and in engine power and enginemen's wages there are 77 engine miles freight shunting to every 100 miles run by freight trains. There are two categories in shunting, but no particulars are given in the annual returns as to the division of the cost between the two forms. In one category is the shunting familiar to most of us—the attaching and detaching of wagons in stations and yards—and the other is the breaking-up of freight trains on their arrival in large marshalling yards and the sorting out of the wagons into the numerous sidings, each of which is allocated to a certain destination. Thus, at the new Whitemoor yard, mentioned below, there are about forty sidings, into which are shunted wagons that will later form a complete train from each siding to the destination for which that siding is allocated. In the first fifty years of railways, trains were broken up and distributed into such sidings by horses, as exampled on the Midland Railway at Toton, at the foot of the Erewash Valley, and at Chaddesden, outside Derby—at the latter yard ninety horses were engaged in shunting wagons. These and similar sidings were laid on the flat, but for many years the inclination of the railway at Jarrow, also at Accrington, had provided a ready means by which wagons were economically shunted by gravity. The first of what are now known as gravitational sidings were laid down by Mr. T. E. Harrison, the then chief engineer of the North-Eastern Railway, at Shildon, near Darlington, and opened in 1869, and they were followed by similar sidings at Newport, near Middlesbrough. Mr. Harry Footner, however, went further, when, in 1873, he took advantage of the contour of the land outside Edge Hill to construct two "gridirons," into the first of which wagons gravitated and were roughly sorted into areas, and thence into the second to be ready for complete trains to destination. Shunting by artificially-made gravity—*i.e.*, by a hump—is of more recent years, and there are several examples of that, *e.g.*, at Wath on the former Great Central, Feltham on the Southern, and Bristol on the Great Western.

We are led to refer to this subject by the reading, at the Institute of Transport on Monday last, of a paper by Mr. H. N. Gresley on a feature to be found at the Whitemoor new marshalling yard of the London and North-Eastern Railway near March. There, trains arriving from the North are broken up and their wagons distributed for various destinations, mainly on the former Great Eastern Railway. The accommodation consists of ten reception roads, each holding eighty wagons, and about forty sidings, of an aggregate capacity of 3679 wagons, into which the arriving wagons are sorted by hump shunting. There are two novel features about this yard, and it was to a description of them that Mr. Gresley's paper was devoted. One is the Froelich hydraulic wagon brake and the other the electrical operation of all the points, some of which are, further, moved in sequence automatically.

The Froelich wagon brake is really better described as a wagon retarder, since the word "brake" rather suggests that it is part of the equipment of the wagon. In hump shunting, the train to be distributed is pushed up one side of the hump, and at the brow the wagons are detached and run down the other side, which usually is on a falling gradient of 1 in 40, and the impetus takes them into the required sidings. Their speed, when inside the sidings, must be regulated, so that they may run well forward or be stopped short, according to the occupancy of the sidings. For that, an ample supply of men to apply brakes is necessary—hence high labour cost—but violent contact with other wagons frequently occurs—hence, also, damage to trucks and to their contents. The provision of retarders checks the wagons, so that they enter the sidings at a suitable speed, and there is little or no occasion for men to follow them up. At Whitemoor the single road off the hump divides into eight main roads, each of which, in turn, serves about five sidings, and the whole of the forty-odd sidings are laid out balloon shape. The balloon plan brings the siding points better within the range of the operating signal-box or control tower, whereas when they is laid in ladder fashion, with the points following one another in succession, off one common road, the further points are not only out of range, but their control on conflicting points is difficult to secure. Each train to be sorted stands, after arrival, in one of the ten reception lines, and all men concerned are given a card of the wagons and the sidings each is intended for. The train is broken up by a shunter into cuts—of one or more wagons to each cut—and as the cuts run down the hump they pass into one of the eight groups. The rail brake consists of a table supported on hydraulic cylinders, by which it can be raised 4¾in. This table is about 50ft. long and carries two pairs of longitudinal rails outside and normally level with the top of the running rails. When the table is raised these brake rails exert a pressure by means of a toggle action on the inside and outside of the tires of wagons passing along the table, producing a braking or retarding effect on the wheels. The pressure applied by these braking rails is increased or reduced at will by means of the operator in the control tower, and the maximum effect is such that a wagon running at 15 miles per hour can, if necessary, be brought actually to a standstill before it has run the full length of the brake table.

The points are also operated electrically from the tower and controlled by track circuits, each 38ft. long, which hold the points whilst the wagons pass over them, and then, until they have passed the fouling point in their own siding. Experience has shown that from sixty to seventy wagons can be split up into forty different sidings in six or seven minutes, whilst Mr. Whitelaw, the L. and N.E.R. chairman, told the annual meeting of that company that he saw sixty wagons completely shunted and disposed of in eight minutes instead of the customary half an hour. Such results, it seems to us, appear to justify the expense that is being incurred, inasmuch as they will bring down the high cost of shunting mentioned in our opening sentences above.

There yet remain three features of this installation which call for mention. One is that the gradient adopted for the descending hump is 1 in 18 instead of 1 in 40, and therefore a given distance is travelled by a cut in about half the usual time. Consequently, wagons may follow each other at one-half the interval in general use. That is a point that has, in turn, been governed by the length of the track circuit, as there time must be given for the latter to be cleared and the points moved before the following wagon reaches it. The second feature is that many wagons still have their tires secured to the wheel centres by bolts, which would interfere with the operation of the retarders. A detector is, therefore, provided, which causes such bolts to ring a bell, and action is then taken to deal with that particular wagon specially. But possibly the third feature is the most noteworthy. The switches in the tower which operate

the points are actuated, to suit the order of the coming cuts, before the wagons have left the hump. The intended "movements" are "stored up" in a drum, and as each cut passes off its fouling point the drum moves and sets up the road for the next wagon. The operator in the tower thus has not to watch and wait for the wagon to run clear; that is done automatically.

Committee on Industry and Trade.

WE give below the conclusion of the Final Report of the Balfour Committee issued on Monday last.

It is usual to end a Report of this nature with a list or summary of conclusions, and in many cases this practice has much to recommend it. Besides its undoubted convenience to the reviewer, it saves the busy reader the trouble of perusing the Report itself, and it shows the various public authorities, or other bodies concerned, the nature and extent of any new responsibilities which it is proposed to cast upon them without the necessity of paying attention to those parts of the Report which may not so directly affect their activities.

These benefits are, however, always purchased at the cost of certain disadvantages, which may sometimes altogether outweigh them. Epitomes of conclusions always lose much of their value by being separated from the background of the general survey and discussion out of which the finding emerged, and from the qualifications with which they were there surrounded. Sometimes the result of such severance may be to give a distorted impression of the general trend and outcome of the inquiry.

We are strongly convinced that in the case of the present Report, much of the value of which must consist in the examination of industrial and commercial conditions and problems, any attempt to epitomise the results in a formal list of conclusions would not only be difficult, but would to a large extent defeat the object of the inquiry. The case might have been different had our inquiries led us to believe that we had discovered some single sovereign specific for all the difficulties which beset British industry and trade. As, however, will be clear to every reader of our volumes, this is not the case. Under each of the headings of our classification we have made certain recommendations, some giving rise to practical action, others deprecating forms of action which we believe to be harmful. The net result is a multiplicity of findings, some positive and some negative, some dealing with questions of principle and high policy, some with points of technical detail, of which the mutual connection and bearing on the central problem referred to us will not always be apparent without a comprehensive study of the whole Report.

While for these reasons we have abstained from appending to this Report any detailed summary of recommendations, we feel that before concluding our labours we ought to draw special attention to certain broad results of a practical order on which the whole of our investigations appear to converge.

It is unnecessary for this purpose to recapitulate what has been set out already in the present and the preceding volumes with regard to the general scope of our reference, the nature of the inquiries which we have pursued, or the lights and shades of the picture which has emerged from those inquiries. It has been made abundantly clear that in producing the economic situation in which this country finds itself, not one but many causes have been at work.

Some of these causes, like the growing tendency towards economic nationalism, the industrialisation of agricultural countries, or the periodic oscillations of industrial activity and employment, have been in operation for many years, and have only been intensified and brought into clearer relief by the economic dislocation caused by the Great War.

Others are the direct offspring of war conditions, as, for example, the great destruction of life, the stoppage of emigration and the disturbance of the normal age distribution of the population; the after effects of the abnormal inflation of the "munition" industries, the loss of goodwill caused by the cutting off of external markets, the obstacles offered to the resumption of trade by the chaotic condition of foreign currencies and exchanges, and by the increase of trade barriers; and last, but not least, the huge destruction of wealth and the crushing burden of debt under which the country has been staggering since the war.

The combined result of these and other causes has been to impair the competitive power of British trade in overseas markets, and since the maintenance of this trade is vital to the very existence of the population, the main practical problem which emerges from all our inquiries is a perfectly plain one, viz., to find the means of restoring the competitive power of British industry and trade without impairing the standard of living, and of enabling British exporters to place their products in external markets in sufficient volume and on terms acceptable to overseas buyers.

It is, we think, abundantly clear from our survey that the first step towards putting British industries in a position to compete successfully in overseas markets, is to subject their organisation and equipment to a thorough process of reconditioning. To carry through this process successfully two prerequisites must be fulfilled. In the first place, there must be an active *will* to reorganise, based on real insight into the changing conditions and needs of the national and international economic situation. In the second place, there must be the *power* to reorganise, based on adequate means of access to the financial and technical resources necessary for material equipment, together with the wholehearted co-operation of all the human factors to ensure that the best results shall be obtained from the transformation.

It has been made plain in the preceding pages that the reconditioning of British industry will undoubtedly involve a great deal of scrapping and replacement of plant, and enlargement of the industrial unit, both by growth and by the re-grouping of units through consolidation or other forms of association, so as to obtain the full benefits of large-scale production, elimination of waste, standardisation and simplification of practice, and all the other measures of economy usually included under the comprehensive term of "rationalisation."

On the other hand, great judgment and discrimination and even restraint are necessary in carrying out the transformation, in order to preserve those special characteristics of variety and quality of products which have been the main strength of British industry and commerce. This necessity imposes severe limits on the extent to which simplified methods of mass production or schemes of intensive amalgamation can be advantageously introduced into British manufacturing industry.

Within those limits, however, there is an immense field for useful action, which must not by any means be confined to physical and technical reorganisation. The human factor is of supreme importance, and *pari passu* with the enlargement of the business unit and the reconditioning of plant and equipment it is essential that there should be at least an equivalent improvement in the quality of the higher control.

This involves a great change in the attitude of the average business man towards new ideas, and in particular towards the results of scientific research and of higher education. The fine natural qualifications of the British business community for industrial leadership, to which we have paid ungrudging tribute in the preceding pages, need to be supplemented and fortified, and to obtain freer scope and a wider field for their effective exercise, through the addition of other qualifications in which at present they are relatively deficient, and which require effort and training for their acquisition. The nature of these deficiencies and the remedies to be applied have been examined in the various sections of this Report. We have confidence that if our recommendations under these headings are seriously studied and wholeheartedly adopted, a type of industrial leader and administrator will be evolved who will be fully capable of directing British industry and trade, as re-equipped and reconditioned, to the best advantage.

Turning to the second pre-requisite of reorganisation, viz., the power to carry through the necessary changes, we find ourselves faced with two main limiting factors.

The first limit arises from the defective power of many depressed British industries, including some of those on which our competitive position has hitherto largely depended, to find the necessary capital to carry out the re-equipment which is essential to the restoration of their health. It has been shown that the root cause of this incapacity is not any defects on the part of the British banks or other financial institutions, which are undoubtedly able and willing to supply industry with all necessary facilities on reasonable terms of security. Nor does it arise from any indisposition of the public to subscribe new capital for industrial concerns provided that there is a prospect of obtaining a reasonable return. This is abundantly shown by the ease with which such industries as are earning good profits are able to secure all the capital they need. The tap root of the mischief is the continued unprofitableness of so many industrial concerns, which makes them unable either to give security to the banks or to offer an attractive investment to the public.

We seem here, at first sight, to be faced by a dilemma, for industrial health can only be restored by the aid of fresh capital, and fresh capital can only be attracted by the restoration of healthy conditions. What is the way out of this vicious circle?

There is no dearth of suggestions, including such diverse proposals as tariff protection, currency reform or the management of industrial enterprises by public authorities. On these subjects we have made what observations and recommendations we deem necessary in the various sections of this Report. Here it suffices to say that each and all of them has to be judged by considering its ultimate effects, direct and indirect, on our whole industrial and commercial position, rather than in relation to a single transitory problem however important. Without prejudice to our view on the questions of high policy here raised, and while fully recognising that the general economic policy of the State may contribute to ease the difficulties of the transition, we are profoundly convinced that the first steps towards breaking the circle must come from the industries themselves.

We do not believe that any of our principal basic industries have been so weakened, even by the long continued depression, as not to have the power within themselves to take the first measures towards their own regeneration, provided that they are thoroughly convinced that such measures are essential and unavoidable, and that they must be taken by themselves without reliance on any outside authority.

The precise nature of these measures must depend, of course, on the differing circumstances of each industry, but their essential character has been made sufficiently plain by our examination of the whole problem, both in our surveys of industries and in the section of this Report dealing with industrial structure and combination. At all costs, power of access to new capital must be regained, and for this purpose measures of financial reconstruction, writing down of capital and amalgamation with other undertakings, so as to increase the size of the business unit, are or may be among the essential measures to be taken, painful as some of them may be. If, however, these initial steps towards rehabilitation be taken with courage and judgment, each subsequent step will become progressively easier, until at length a fertilising stream of new capital will again begin to flow into the industry and solve, or simplify the ultimate solution of, the problem of reconditioning.

As the aim of reconstruction must be to operate the most efficient works full time, the result will be to afford the maximum amount of full employment and at the same time to diminish the number of part-time workers. Such a policy in its early stages may involve an actual increase in the number wholly unemployed, and all possible steps should be taken to mitigate any hardship incidental to the transition. If, however, as we believe, this is the only practicable road by which competitive efficiency can be restored, it is better to face this temporary evil than to drag on as at present, and we may be confident that in the long run the industries which have regained their prosperity will be more than able to re-absorb those who for the time may have been displaced.

Considerations of this order lead naturally to an examination of the second important limiting factor with which we are faced when endeavouring to increase the efficiency and reduce the costs of productive industry. This arises from the imperfect co-ordination of the various human agents who contribute to the process of production. It is true that at the present time the relations among the different classes engaged in British industry, and particularly the relations between employers and employed, are certainly at least as good as in any other country and better than in most. Moreover, in spite of such symptoms of unrest and inflamed feeling as marked the widespread stoppages of 1926, we feel, and the evidence before us supports this view, that industrial relations are generally on a healthier footing to-day than has been the case for many years. This being so, the present is an exceptionally favourable opportunity to take a further step in the direction of close and intimate co-operation.

In the sections of this Report dealing with conditions of employment and industrial peace, we have put forward certain recommendations for completing and strengthening the means of joint consultation, negotiation and co-operation. We are convinced that the full advantages of the reorganisation and reconditioning of works and equipment can only be reaped if the employees and their representatives are looked on as partners in a joint enterprise and frankly taken into confidence as such.

On the other hand, there is urgent need, not only among employers and managers, but at least as much among workpeople and their organisations, for a more vivid and intelligent appreciation of the importance of "mobility"—using the term in its widest sense, to cover, not only actual transference, whether industrial or geographical, but also a mental attitude towards changes of environment and the power and will to react promptly to such changes.

It is an essential condition of real industrial reorganisation on sound and efficient lines that each partner in production shall give of his best, and give it in such a way as to conduce to the maximum efficiency of the whole undertaking. To allow this principle full scope an end must be made of trade restrictions and demarcation rules, whatever be their origin and explanation, which hinder a worker from exercising his full powers and intelligence in the performance of any work which he is capable of carrying out efficiently, on condition, of course, that he is properly remunerated. We are aware of no other country that suffers nearly so much as Great Britain from artificial and hard and fast lines of demarcation between different skilled crafts, or between workers of different grades of skill, and this disability is more acutely felt than ever in a period of rapid economic change, when old lines of distinction are necessarily becoming less and less consistent with the realities of productive economy. We are glad to believe that the responsible leaders of labour organisations are becoming increasingly conscious of the importance of removing or relaxing demarcation rules that hinder industrial mobility, and we earnestly hope that they will lose no opportunity of urging on those whom they represent the vital necessity of taking the broader view. In the same connection it is satisfactory to note the growing trend of opinion in favour of some form of payment by results, whether individual or collective, which, if properly safeguarded, affords each individual or industrial group the maximum

opportunity and incentive to exercise their skill and energy to the best advantage.

We do not under-rate the demands that will be made on all the partners in industrial and commercial enterprise if a serious effort is to be made to carry out our recommendations. We have dealt elsewhere in this Report with the steps that would have to be taken by the various trade associations and other industrial and commercial organisations to equip and fit themselves in all respects to take the strain of the greatly increased duties which under our recommendations they would be called upon singly or jointly to undertake.

It is further evident that, if scientifically equipped and managed enterprises are to be operated with a hitherto unknown intensity, the problems of industrial fatigue and the whole range of questions generally classed as "welfare" cannot fail to assume a much increased importance, a consideration which adds great weight to our findings with regard to this group of subjects. Moreover, the changed conditions, especially during the stage of transition, are likely to make much higher demands on employers and employed for mutual consultation and co-operation than have hitherto been customary in British industry.

We confidently hope that all these new demands and new duties will find the ready and general response which the situation requires and the nation expects.

The Institute of Metals.

No. I.

Additional interest attaches to the annual general meeting of the Institute of Metals, held this year in the hall of the Institution of Mechanical Engineers, Storey's-gate, Westminster, on Wednesday and Thursday, March 13th and 14th, in that it marks the Institute's twenty-first anniversary. As is usual at these meetings, two days were devoted to the reading and discussion of papers, and the annual dinner of the Institute was held on Wednesday evening. To celebrate the coming-of-age, a conversazione was held at the Science Museum, South Kensington, on Thursday, in connection with which a metallurgical exhibition was arranged.

At the opening meeting a particular welcome was extended by the President—Dr. Walter Rosenhain, F.R.S.—to a number of members who had come from abroad to attend the conference and take part in the celebrations, and he welcomed especially the German members, in whose country the Institute's autumn meeting is to be held next September.

A point worthy of special mention is the Institute's growth of membership. It has been the aim for some little time to increase the membership to 2000, and it was particularly fitting that the Secretary and Editor—Mr. G. Shaw Scott—should have been able to announce, on the occasion of the twenty-first anniversary celebrations, that the number of members on the roll is 2022.

The Annual Report.

The Secretary then presented the annual report of the Council for the year ended December 31st, 1928. From it we extract the following paragraphs:—

It is encouraging to be able to report, at this the twenty-first annual general meeting of the Institute of Metals, that the membership passed the total of 2000 at the end of 1928—the year covered by the present report.

The opportunities of service to members have been increased in many ways during the past year, notably as a result of the large extension in the library and office accommodation. A still more important development has been envisaged recently by the Council. The proposal has been made that the Institute should co-operate in a scheme which has for its object the securing of a suitable site and building to accommodate a number of institutions and societies having somewhat similar aims, so as to secure economy by co-operation in certain services, and by the use of a common meeting hall, library and committee rooms.

The Council has in hand arrangements for the next Autumn Meeting, to be held in Düsseldorf, Germany, from September 9th to 12th, by the kind invitation of the Verein Deutscher Ingenieure and of the Deutsche Gesellschaft für Metallkunde. Steps are also being taken in connection with the visit of the Institute to America in 1932.

The financial year which ended on June 30th last covered the first complete year of the Institute in its new quarters at 36, Victoria-street Westminster. As increased liabilities resulted from the sudden expansion of the Institute's premises, whilst the membership curve moved only normally, the surplus of income over expenditure at the end of the past year—£150—was somewhat less than in 1926–27. This was but the natural result of the recent doubling of the library and office accommodation, and the appointment of a full-time librarian, before the membership had had time to grow in proportion to the cost of the additional services rendered.

The President, who moved the adoption of the report, said that the Institute could congratulate itself on having reached its twenty-first anniversary and on having attained so good a status and so prosperous a condition. But whilst the members might feel that there was a good deal for self-congratulation, it was necessary to realise that it was their duty, as the followers of those who had established the Institute, not to rest content with the position so far reached, but to work further for the advance of the Institute and all it stood for and aimed at. There was a very great deal of work still to be done. The work already done had been of enormous value to the non-ferrous metal industry and to the progress of the science of non-ferrous metallurgy generally. That work, however, must be regarded as being little more than a beginning. The Institute had initiated a new era in non-ferrous metallurgy, but it was the task of the present members, and those who succeeded them, to develop that era to its fullest activity. By so doing they could not fail to develop also the fullest prosperity of the industries with which they were directly or indirectly associated.

There having been no further nominations since those put forward at the autumn meeting of the Institute, held in Liverpool last September, the members then nominated for election as office bearers for 1929 were declared elected, as follows:—President, Dr. Walter Rosenhain, F.R.S.; Vice-Presidents, Mr. T. Bolton (London), Lt.-Col. Sir Henry Fowler, K.B.E., LL.D. (Derby); Members of Council, Mr. R. Lloyd Gibbins (Birmingham), Dr. H. Moore, O.B.E., D.Sc., Ph.D. (London), Mr. H. A. Ruck-Keene (London), Mr. J. Steven (Glasgow), Mr. W. G. Turner, O.B.E. (Sheffield), Mr. H. B. Weeks (London).

It was announced by the Secretary that the Council, having felt it desirable to mark the coming-of-age of the Institute in some special way, had concluded that the election of its Past-Presidents and the present President as Fellows would mark the occasion very fittingly. He announced, therefore, that the following had been elected Fellows:—Dr. Walter Rosenhain, F.R.S., Professor H. C. H. Carpenter, Engineer-Vice-Admiral Sir George Goodwin, Engineer-Vice-Admiral Sir Henry J. Oram, Mr. Leonard Sumner, Professor T. Turner, Sir John Dewrance.

A hearty vote of thanks to the officers and Council for their services to the Institute was accorded, on the motion of Mr. G. B. Brook. He commented upon the great value of the Institute's publications and its work generally, and said that it had been fortunate in having been guided by officers of great eminence. Having celebrated its twenty-first birthday the responsibilities of the Institute became greater than previously; still greater development would be expected in the future, and he felt sure that every member would contribute to that greater development.

The President, in a brief response, paid a tribute to the members of the permanent staff of the Institute for their enthusiasm and their able backing of the efforts of the officers. The status which the Institute had attained was, he said, due to the harmonious co-operation of the officers, the staff and of the individual members. He assured the members generally that their interest, even if it were at times critical, was always welcomed by the Council. Finally, he expressed his appreciation of the honour the Council had done him in electing him a Fellow of the Institute.

Dr. Maass (of Berlin), in an address which he delivered in his native tongue (and which was interpreted by the President), conveyed the hearty greetings of his colleagues in Germany, and made two important suggestions as to steps to be taken for dealing with the problem of corrosion. After stressing the importance, from the economic and general points of view, of protecting metals against corrosion, he put forward the proposal that an international congress to discuss the matter should be organised. Secondly, speaking as chairman of the German National Committee for the protection of metals, he said that that body desired to enter into closer co-operation with the Institute of Metals in connection with corrosion problems, and had appointed one of its members (Dr. Max Haas) to act as liaison officer between the two bodies.

The President said that he felt sure the Corrosion Research Committee of the Institute would welcome a step of that kind towards closer co-operation with so important and vigorous a body as the German Committee on Corrosion.

Professor D. Hanson announced that the Council had accepted with very great pleasure the gift of a profile plaque, in bronze, of Dr. Rosenhain, which had been presented by Mr. H. Sloman, M.A., of the National Physical Laboratory, to be housed suitably in the Institute's offices in recognition of Dr. Rosenhain's services to the Institute. All the members, and particularly Dr. Rosenhain's personal friends, derived considerable satisfaction from the fact that he was occupying the position of President during the Institute's twenty-first birthday year. Mr. Sloman was a member of Dr. Rosenhain's staff, and Mrs. Sloman was an artist of considerable skill. It had not been possible to ask Dr. Rosenhain to sit for the purposes of preparing the plaque, because it was not desired that he should know of its preparation in the early stages, and probably Dr. Rosenhain had been surprised that he had received a large number of invitations to play bridge. It was only in the latter stages that he had been informed, and his approval had been obtained. They all knew Dr. Rosenhain's great work as a scientific metallurgist. They were proud of his scientific record, and the Institute had gained a great deal because of his scientific eminence, but those who had worked on the Council in close co-operation with him knew well that that was only a portion of the service he had rendered to metallurgy. From the outset he had been in the forefront in guiding the Institute's destinies; his work as chairman of the Publications Committee was reflected in the high quality of the *Journal* of the Institute, which was recognised throughout the world as a magnificent production; and in his position as President he was guiding the Institute through a very important stage in its development. Finally, Dr. Hanson expressed the Institute's best thanks to Mr. and Mrs. Sloman for their very acceptable gift.

The President, who admitted that, on this occasion, he was in the unusual position of being at a loss for words, said that the Council, without consulting him, had decided to accept the gift. He appreciated very highly indeed the spirit which had prompted the gift and the generous words with which its acceptance had been announced by his old friend and colleague, Professor Hanson.

The discussion of papers was then proceeded with.

Annual Dinner.

The annual dinner of the Institute, followed by a dance, was held on Wednesday evening at the Trocadero Restaurant. Two hundred and fifty members, guests and ladies were present. Dr. W. Rosenhain presided. In giving the toast of "The Institute of Metals," Sir Samuel Hoare, Secretary of State for Air, referred to the great development of aviation during the life of the Institute. The silent revolution which had taken place during the last three years in which wooden machines had almost entirely been replaced by metal machines, had been made possible by the research and experimental work of metallurgists on the light metals and their alloys. In the new metal machines the weight, compared with the old wooden types, had been reduced by 15 per cent. in the case of land machines, and 25 per cent. in the case of flying boats. A metal boat in which he had flown was, he was told, almost one ton lighter than its wooden counterpart. Three years ago the Air Ministry had ordered 21 metal machines against 392 wooden machines over a period of twelve months, whereas in 1928 the number of metal machines ordered was 432, against 63 wooden machines. Wooden machines would in future only be used for training. The toast was acknowledged by the President, who recounted some incidents in the history of the Institute. Lord Melchett proposed the toast of "The Guests," and emphasised the continued need for research. Sir Ernest Rutherford, the President of the Royal Society, replied, and Dr. W. Rohn, the representative of the Verein Deutscher Ingenieure, and the Deutsche Gesellschaft für Metallkunde, also spoke.

(To be continued.)

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

CANALS AND TRANSPORT.

Sir,—Your correspondent, Mr. J. W. White, of Widnes, in passing a little criticism on a letter of mine you were good enough to print—February 22nd—raises points worth attention. Next to production itself, transport is most important. If anything can be done to cheapen transport, let it be done by all means. But I submit that, save in very small and special areas, canal transport offers no help in our country, owing to the uneven nature of our ground.

Mr. White is right in assuming that the barges on which I was reared were horse-drawn ones; but I think he is wrong in saying that "if modern methods had been used to draw the barges there would have been a different tale to tell." Please let me explain that I am familiar with the most modern methods of hauling barges, and still I condemn the movement or agitation in favour of a great canalisation scheme.

In Yorkshire we have had for many years the most efficient canal system, the most modern barges and methods of hauling, that I can think of. The Aire and Calder Navigation, between Hull and the West Riding, has not only tide water for about half the distance—specially favourable natural conditions—but it has level country for another considerable part of the distance, and it has two fairly good rivers. Furthermore, it has such well-kept canals, such well-built barges, such unique coal-carrying "compartments," such tugs, such hoists and other equipments as I have seen nowhere else in this country or abroad, or heard or read of. If it is possible for a British canal system to be 100 per cent. efficient, that system is the Aire and Calder Navigation in Yorkshire. Nevertheless, I find that in an ordinary month Hull receives less than 20,000 tons of coal by barge, but 300,000 tons in railway trucks. I submit that this is eloquent evidence in favour of my contention that canal transport is not economical in our country.

Take France. Although nearly all the French canals have good levels and many natural rivers to favour them, a recent census showed that they were declining, as measured by number of barges and men employed. Not only so, but whereas the railways are self-supporting, the canals are assisted out of public funds, and in order to give the canals a chance the State compels the railways to charge unnaturally high rates for coal and related traffic. Under conditions of fair competition, the canals, even in France, would make a very poor showing.

In the United States a canal running through flat country, after costing millions of dollars of public money, is reported by Government Commission as a failure, doing little and diminishing business, whilst the railways are carrying more and more goods, even coal.

Mr. White's suggestion that the universal adoption of mechanical haulage on our canals would "alter the whole aspect" of our problem is, in my opinion, mistaken. No sort or kind of haulage can overcome our natural dis-

advantages in the matter of inland water transport. Our country is hilly. It possesses few rivers suitable for economical canalisation. We have difficulty now in maintaining a sufficient water supply for the top reaches in dry weather. If we widened and deepened our canals, made our locks and barges bigger, and greatly increased our canal traffic, the supply of water for the top levels would present an almost impossible—certainly a highly costly—engineering problem. Our little island will present a serious water difficulty in a few years' time, without the added difficulty of a big canal system. Our catchment area is limited. Our population is big. Houses are being fitted more and more with baths, water-carriage systems, &c., and a water famine is not a matter or question for the very dim and distant future. To sum up, Britain is a first-class railway country, as it is a first-class ocean shipping country; but a first—even a third-class—canal country it cannot be. Any money we have to spend, public or private, had better be spent on extending and extra-tracking our railways. Canals are a back number, as are oil lamps and tallow candles.

E. T. GOOD.

Sheffield, March 12th.

THE LANGUAGE QUESTION.

SIR,—Your remarks concerning the language question are seasonable and to the point. It seems, however, rather extraordinary that the technical Britisher has not taken more notice of that artificial, scientific, systematic, international language of Esperanto. It is apparently much more to the front in other countries than here, and the fact is significant that the Esperanto Congress in 1928 in Antwerp attracted upwards of 1500 delegates from thirty-five countries, whereas at that in 1921 in Prague nearly 2500 delegates represented over forty nationalities. This does not indicate a falling off, but the more widespread interest, where the language question is more apparent than here.

Most technical men have at least a knowledge of Latin, which is of considerable assistance, considering that most of the root words are derived therefrom.

The Esperanto pamphlet of the Leipzig Fair is worthy of notice by our own Fair Committees. To those who think everybody should speak English or are doubtful as to the spreading of Esperanto, I would refer them to an article in the current—March—number of *International Language* entitled "Looking Eastward," or to the programmes of the continental radio broadcasting stations.

With regard to the language itself, the Esperanto-English section of the dictionary occupies about one-third of the pages allotted to the English-Esperanto section, and a working knowledge of about 500 roots and about 30 prefixes and joint roots give a total of some 25,000 words available—a truly remarkable attainment. The grammar can be learnt in an hour.

R. B. ASKQUITH ELLIS.

March 11th.

EX-SIEMENS' MEN.

SIR,—The undersigned have had inquiries from time to time as to whether there is an organisation through which ex-Siemens' men can foregather, and it appears that such an organisation would meet the wishes of many.

We are therefore seeking the courtesy of your columns to invite those who have been connected with any of the Siemens concerns in the past—both at home and overseas—to communicate with one of the undersigned.

If there is sufficient response, it is proposed to form a small committee to arrange, in the first instance, a reunion.

J. SNOW HUDDLESTON,
Union Cable Company, Ltd.,
Dagenham.
E. P. BARFIELD,
Wild Barfield Electric Furnaces,
Ltd., North-road, Holloway,
N. 7.

March 11th.

BRUNEL AND THE BROAD GAUGE.

SIR,—In your issue of to-day, it is stated in the most interesting review of Mr. Sherrington's book that until quite recently no one has had the courage to question the younger Brunel's standing as an engineer. This reminds me of the following amusing sentence in Francis' "History of the English Railway," published in 1851:—"When the elder Brunel devised the tunnel beneath the Thames, it was genius; when his son devised the broad gauge, it was a lower order of the inventive faculty."

G. ROYDE SMITH.

Watford, Herts., March 8th.

RAILWAY CONSTRUCTION IN MANCHURIA.

RAILWAY construction in Manchuria has, according to the Chinese Bureau of Industrial and Commercial Information, been making rapid progress during the past few months.

The Suihua-Hailun section (103 miles long) of the Hulan-Hailun Railway north of Harbin was completed on December 7th and opened for traffic from December 15th. The Angangchi-Tsitsohar extension of the Taonan-Angangchi Railway (31 kiloms. long), was completed on December 8th and traffic was opened on December 11th. Through traffic from Tahushan on the Peking-Mukden line to Angangchi having been instituted on December 1st *viâ* Tungliao-Chengchiatun, Taonan-Tsitsihar has now direct communication with Tahushan. On the Kirin-Hailungcheng Railway, the section between Chaoyang and Panshih was opened for traffic on November 11th, and the remaining work is being energetically pushed on. For the construction of this railway 17,500,000 dollars is said to have been provided by the Kirin Provincial Treasury, while 2,000,000 dollars was obtained by private loans. The length of the whole line is about 124 miles. The new railway from Hailin on the Chinese Eastern Railway eastern section towards the south to Tungchingcheng, *viâ* Ninguta, a distance of about forty miles, was built mainly for the purpose of timber transportation.

Various new railway lines for Manchuria have, also, been projected. One of them is the Mukden-Fakumen line, which is probably intended to be extended further north-west to Chengchiatun, thus affording Mukden direct communication with Tsitsihar, without having to use the roundabout way over Tahushan. It is reported that 30,000,000 dollars is to be raised for this purpose, one-third each by the Government, the principal banks and public subscription. Another railway is being planned from Hailungcheng E. S. E. to Fusung, and a surveying party has already been sent out by the Mukden-Hailungcheng Railway Construction Office. A third new railway scheme aims at traversing the whole of Eastern Kirin by a railway extending from Kirin across the Chinese Eastern Railway to Fangcheng on the Amur River, for which purpose 80,000,000 dollars is to be raised (one dollar = approx. two shillings).

American Engineering News.

Air Conditioning in a Flour Mill.

Under ordinary operating and atmospheric conditions a flour mill has its best efficiency during the spring and autumn, because temperature and relative humidity are most favourable and their daily variations are at a minimum. The purpose of air conditioning is to maintain these favourable conditions throughout the year, and that can be effected within fairly close limits. After a study of blower and refrigerating systems, which failed to promise reliable or economical results, the Allen Smith Company's mill at Knexville, Tennessee, was equipped with an air-conditioning plant which includes an air washer, a pump for circulating spray water through the washer, a pre-heater, a reheater, a fan, control equipment, and ducts for distributing the conditioned air. Its purpose is to enable the mill to produce a uniformly high grade of flour, to maintain a high capacity of output of the desired quality, to reduce the evaporative loss and yet maintain the necessary moisture content of the flour, and to eliminate soot, dust and other foreign particles. It also materially improves working conditions for the employees. To prevent the unfavourable effect of heat from rolls and bearings, especially in summer, as the hot stock does not grind well, cool moist air is blown between the rolls, thus absorbing the heat due to the machine operations. For the same reason, the purifiers are treated or bathed in the conditioned air to control the temperature and prevent loss of weight of the stock by evaporation. The system is of special advantage at this mill owing to heavy mountain fogs, and the trapping of coal smoke and soot in these damp fogs which settle down in the valley where the mill is situated.

Road Machinery Development.

The vast programmes of road construction, bettering and maintenance in the United States has had its result in a great development and continual improvement of road machinery. At the annual "Road Show," held at Cleveland in January, there were more than 400 exhibitors of machinery and materials, occupying a total of eight acres of floor area, while the number of visitors exceeded 20,000. In motive power, petrol engines were most numerous, but oil or Diesel engines are increasing rapidly, while steam was in a negligible minority. Two special lines of development were motor trucks having special bodies for carrying concrete long distances from a central mixing plant, and numerous batch or measuring machines to proportion concrete material by weight instead of by volume. Features in machine construction were the extensive use of ball and roller bearings, steel castings, filters for oil and air, silent chain drives, cut gears running in oil and crawler supports in place of wheels. Snow ploughs and snow handling equipment, concrete finishing or surfacing machines, asphalt patching equipment and special machines for use by maintenance gangs or road patrol men were among the special exhibits. Excavators for the rough work and the close finish of formation level, as well as those for deep and shallow trenches for pipes, were shown in great variety. Stationary and portable crushers and screens together with gravel washers, belt and bucket conveyors, and an array of concrete mixers of all sorts and sizes were shown.

Molten Iron Carried Eleven Miles.

Pig iron for the American Rolling Mill Company is produced at blast-furnaces 11 miles distant from the open-hearth furnaces, and the hot metal is transferred by rail in mixer cars holding 150 gross tons each. Each car is 56½ft. long overall, weighing empty about 145 tons, and is mounted on four four-wheeled bogies, or about 18 tons per wheel loaded. The trip takes about fifty minutes, from charging at the blast-furnace to discharging at the open-hearth furnace, and, as there is very little heat loss, the skulls are reduced to a minimum. In fact, the only skull loss, so far, is in the transfer ladles. Metal has been held in the mixer for sixteen hours, but no trouble was experienced with the iron and there was no skull formed. The mixer revolves on trunnions in end frames of the car, and is operated by an electric motor. It is lined with 2in. of ganister laid against the steel shell, and then 13½in. of brick laid in fireclay jointing. The lining lasts about five months, or carries 40,000 tons of metal. To check cutting or gouging of the brick by the stream of metal from the blast-furnace spout, a small amount of metal is left in the hollow after discharging. The cars are turned end for end occasionally, so that the stream of hot metal will not always strike the same place. The running of these cars, which are hauled by locomotives, is regulated by clerks who also handle the weighing of the hot metal delivered to the open-hearth furnaces.

The Largest Locomotive—Again.

Periodically, some American railway puts in service the largest locomotive in the world, and the latest to hold this record is the Northern Pacific Railway, with a 320-ton engine—gross tons of 2240 lb.—of the "Mallet" simple articulated type, having a wheel arrangement 2–8–0–0–8–4. Behind this is a 180-ton tender on a pair of six-wheeled bogies. The boiler is said to be the largest locomotive boiler ever built, its size and design being governed by the necessity of utilising a local coal which is low in heat units, but burns very freely. This engine will handle a 4000-ton train load on a 220-mile division where at present 2225 tons is the load for a 2–8–2 engine, necessitating the breaking of 4000-ton trains coming from adjacent divisions. The following are the leading particulars of the new engines:—

Cylinders, four	26in. by 32in.
Driving wheels, diam.	5ft. 3in.
Rigid wheel base	16ft. 9in.
Driving wheel base	44ft. 6in.
Engine wheel base	66ft. 8in.
Engine and tender wheel base	99ft 8in.
Length over engine and tender	125ft.
Weight on driving wheels	248 tons.
Weight on leading bogie	20 tons.
Weight on trailing bogie	52 tons.
Weight of engine	320 tons.
Weight of engine and tender	500 tons.
Boiler diameter	8½ft. to 9½ft.
Combustion chamber, length	6ft.
Fire-box	22½ft. by 9½ft.
Tubes, length	22ft.
Steam pressure	250 lb.
Heating surface: tubes	6801 square feet.
Fire-box and combustion chamber	610 square feet.
Fire-box syphons	262 square feet.
Total	7673 square feet.
Superheating surface	3219 square feet.
Grate area	182 square feet.
Water in tender	21,200 gallons.
Coal on tender	27 tons.
Tractive force at 70 per cent. cut-off	139,900 lb.
Booster engine ditto at 50 per cent.	13,400 lb.
Combined tractive force	153,300 lb.
Mechanical stoker, capacity	40,000 lb. per hour.

Non-Pressure Creosoting Plant.

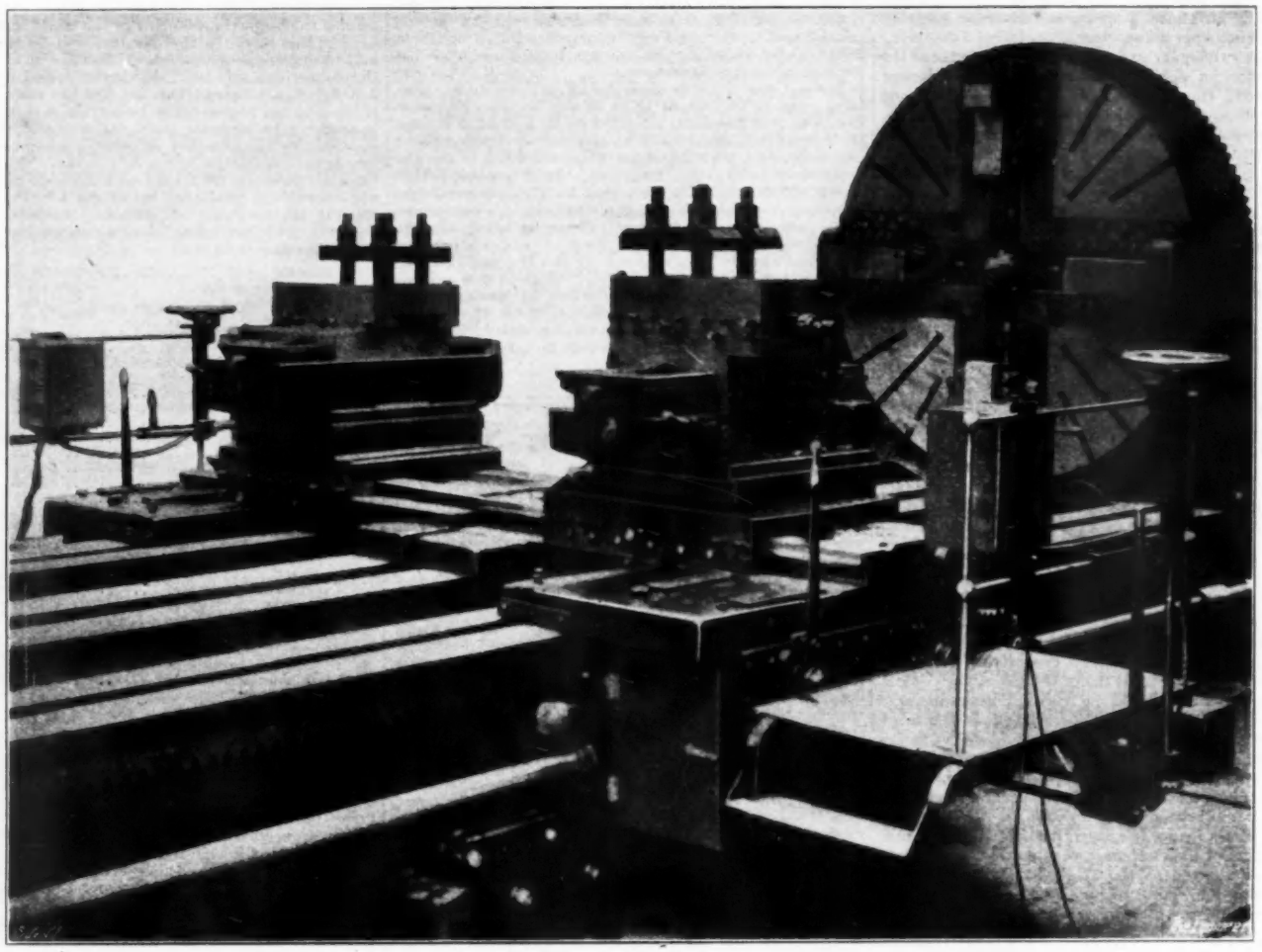
For the preservative treatment of poles and timber the Baltimore Gas and Electric Light Company employs a carefully-planned non-pressure system which gives full penetration of the sapwood. The ordinary dipping process consists usually of submersion in hot creosote for five to fifteen minutes, while the process mentioned requires from four to thirty-six hours, depending upon the species of wood, its size, sapwood and moisture. For butt treatment of poles there is a tank 7ft. by 14ft. and 10ft. deep. Timber is treated in a tank 4ft. wide, 5ft. deep and 40ft. long. A motor-operated derrick and a crawler tractor handle the material. Careful temperature regulation is necessary. In the hot bath, fir cross-arms do not stand more than 215 deg., but pine cross-arms take 220 deg.; round timber may be boiled at 240 deg. for fifteen hours without injury; for sleepers the bath must not exceed 220 deg., as higher temperature causes checking, and for butt treatment of chestnut poles the bath is kept at 230 deg. For the cool bath the temperature is about 125 deg. When hot creosote is removed and cool creosote is pumped into the tank, the greatest absorption takes place in the first hour, but the cool bath should last at least half as long as the hot bath. The creosote in the tank is maintained at a uniform level and the timber is not exposed to the atmosphere during the change in temperature.

WORLD POWER CONFERENCE.—A sectional meeting of the World Power Confernece on the "Complete Utilisation of Water-power Resources," will be held at Barcelona, Spain, between May 15th and May 23rd, 1929, at the same time as the Barcelona Fair. It will be followed by official visits to places of interest in Spain. It is being organised by the Spanish National Committee of the World Power Conference, with the official co-operation of the Spanish Government. The subjects to be dealt with are:—(*a*) General hydrological problems; (*b*) technical problems of water power utilisation; (*c*) economic and financial problems; (*d*) legal problems; (*e*) protective measures and defence works of undertakings. The fee for ordinary membership of the Conference is 30 pesetas, or one pound sterling. Copies of the technical programme (in English, Spanish, French and German), together with forms of application for membership, may be obtained from:—The secretary, International Executive Council, the Central Office, World Power Conference, 63, Lincoln's Inn-fields, London, W.C. 2, England.

LONDON POWER COMPANY STAFF DINNER.—The staff of the London Power Company met for dinner at the Connaught Rooms on Friday, March 8th, the chairman of the company, Mr. W. F. Fladgate, M.V.O., presiding, supported by Mr. W. A. Pearman, the general manager, and Dr. S. L. Pearce, the engineer-in-chief. The attendance of over 200 comprised nearly the whole of the staff, the ladies lending a touch of colour to the assembly. After the loyal toast, the health of the chairman was proposed by Dr. Pearce, and in doing so he drew attention to the prominent part which Mr. Fladgate had taken in securing co-ordination for the electricity companies in London ever since his connection with the industry in 1890. In acknowledging the toast, Mr. Fladgate ante-dated his connection with electricity to the time when, as a boy in 1863, he heard Tyndall lecture on electricity at the Royal Institution, when he said that "some day, perhaps, this wonderful force would be put to the service of man." Since that time a great deal had happened in the electricity world. Then, referring to the staff of the Power Company, he mentioned that the company had been carried to its present position by fine team work. There was still much to be done, and he looked forward to a continuance of the good feeling which existed between all sections of the company. He was delighted to have had the opportunity of meeting them all, and assured them that united co-operation would carry the company forward to still greater success, as it had to be remembered that the London Power Company, of which all were members, was an agent for service. The health of the general manager and the engineer-in-chief was proposed by Mr. Mackenzie, and honoured with enthusiasm. It was felt that this first staff dinner of the company had been most successful and enjoyable, and it was hoped that it would become an annual event.

HIGH-SPEED 42-INCH SHAFTING LATHE

G. AND A. HARVEY, LTD., GOVAN, GLASGOW, ENGINEERS



High-speed 42in. Shafting Lathe.

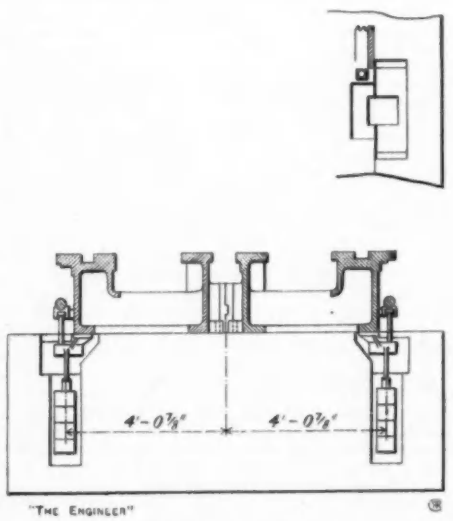
THE lathe illustrated herewith and on page 296 has been produced by G. and A. Harvey, Ltd., of Govan, Glasgow, for John Brown and Co., Ltd., Sheffield. It is designed for rough turning heavy shafts at the usual cutting speeds adopted for high-speed tool steels, but it may also be operated at speeds as high as 200ft. per minute. The slowest spindle speed, 1·33 revolutions per minute, will allow work 5ft. 6in. in diameter, the largest that can be swung over the saddles, to be cut at 23ft. per minute while the maximum spindle speed, 42·8 revolutions per minute, gives a cutting speed of 200ft. per minute on a diameter of 17¾in.

The machine as illustrated is driven by a 160 horse-power motor, but is designed to take a 300 horse-power motor. It is capable of transmitting full power from a motor of the second-named size at speeds down to 4¼ revolutions per minute. At such a speed diameters up to 54in. can be turned at a cutting speed of 60ft. per minute under full power.

The bed is constructed in two widths, each of which is self-contained as regards equipment, strength and foundation bolts. The two widths are stiffened by being joggled and bolted together at every alternate bridge. The total width of the bed is 8ft. 6in. and is such as to ensure that the reaction from the cut on work of the maximum diameter that will clear the saddles is taken entirely within the confines of the bed. There are two outer and two inner shears, all of which are provided with planed parallel square lips for the under slips of the saddles. The top surface of each outer shear is divided into two portions strongly connected together. The inner portion, as shown in the accompanying cross section of the bed, is reinforced by a deep web extending from bridge to bridge, which makes the shear to a large extent double walled. The outer portion acts as a guide for the saddles and is approximately in line with the tractive effort. A cut steel rack is bolted to the front of each outer shear under the overhanging lip. This rack serves for the traversing of the saddles and the loose headstock, and in addition the two racks between them take the surplus back thrust from the loose headstock. The feed shafts at the front and rear of the bed lie low down and close to the web. The shafts are supported at intervals by dipping bearings, each accommodated in a small pit in the foundations. The cuttings from the work are prevented from lodging between the bridges by means of plates covering the entire space between the shears and presenting a smooth top surface, off which the cuttings can be raked or shovelled from time to time.

The driving headstock is in the form of a hollow box extending down to the foundations and bolted to the end of the bed. Its front and rear bearings are directly connected by heavy flanged longitudinal webs. The vertical walls are flanged and reinforced by webs. At the neck the spindle is provided with a hard gun-metal bearing 18in. in diameter by 24in. long. The rear spindle bearing is 14in. in diameter by 18in. long. The face plate gear ring is 13½in. wide. Its teeth are made with a short addendum, the pinion teeth being of correspondingly long addendum. This plan, it is claimed, gives the pinion teeth a contour over which the wear is evenly distributed, which is favourable to the access of oil between the rubbing surfaces and which ensures a very smooth engagement of the pinion with the gear ring. The pinions and wheels driving the face plate pinion shafts have a similar form.

As the lathe is intended to be used expending its powerful drive either in giving higher cutting speeds than have hitherto been commonly employed or in taking extra heavy cuts at the usual high-speed cutting rates, provision had to be made for transmitting the very high



CROSS SECTION OF BED

torques involved, particularly in the second method of working. To this end two face plate pinions are employed to engage with the face plate gear ring. By this means the makers have been enabled to increase the width of the gearing without increasing the overhang of the face plate and also to distribute the load over twice the width of tooth face that would have been available with a single pinion drive. Both the pinion shafts have a bearing on each side of the pinion. The shafts extend to the end of the headstock, where they each carry a large wheel which is driven from a central pinion common to both sections of the drive. It is argued that the length of the pinion shafts permits torsional elasticity to compensate for any minute disparities in the wheels and pinion and so to ensure a practically equal and continuous action on the part of the two face plate pinions. Because of the large ratio of reduction given by this arrangement the speed change gear wheels are subjected to comparatively moderate loads per inch width of face, and as they in addition run under a constant flow of oil from an overhead tank no difficulty, we are informed, is encountered in running them at correspondingly high pitch line velocities. The overhead tank referred to is situated on the frame of the domed cover of the headstock and is replenished with oil by a rotary pump drawing from a sump in the bottom of the headstock. All the gearing and bearings inside the headstock are in this way constantly drenched with oil, but without waste occurring.

The jaw clutches in the headstock are engaged by means of hand levers which operate through sector gearing. When a portion of the canopy is removed and the bearing caps are withdrawn the spindle and face plate can be lifted out of the headstock. The other shafts in the drive can be withdrawn endwise without difficulty, their removal being facilitated by the fact that they are slightly reduced in diameter beyond each wheel bearing. The top of the headstock is covered by a planished sheet steel dome hinged to a frame in such a way as to be opened in sections when access is required to the headstock interior. The sections are held in the closed position by spring clamps.

The main spindle is a high-tensile steel forging and is fitted with a ball thrust for taking loads imposed by work weighing up to 60 tons. At the front end the spindle carries a large flange to which the face plate is bolted. A tapered shank centre can be fitted into the nose of the spindle.

The face plate is 7ft. in diameter and is in the form of a double-walled box casting stiffened by eight ribs in parallel pairs. Additional stiffening is derived from a deep rim at the circumference of the face plate and the steel gear ring which fits on to this rim.

The face plate is provided with a number of tee slots cored in the face and has four jaw slides, which can be adjusted by means of stout screws working in chambered recesses. The jaws are of steel with serrated and case-hardened gripping ends. Each jaw is mounted on a cast steel slide centrally guided and clamped to the face plate by bolts sliding in tee slots. When desired, the jaw slides can readily be detached from the face plates or they can be registered at various radii on the face plate by means of steady pins. Additional details of the face plate will be gathered from the engraving given above.

The loose headstock is mounted on a wide base which bears on all the four shears and which has a long narrow guide between the two innermost shears. The base is provided with a gear-box on each side. The gear-boxes are equipped with rack pinions and with irreversible worm gear drives. The loose headstock is mounted on a wide feather on the base and can be set over by an adjusting screw when taper turning beyond the traverse capacity of the swivel slides on the saddles has to be done. The base is equipped with two independent clamping bolts which, together with the locking of the

traversing gear, hold it in position during the trial adjustment of work of moderate weight. In addition, both the loose headstock and the base can be clamped to all four shears of the bed by a number of strong bolts. The gear-box at the front of the loose headstock is provided with a small motor for quick traversing purposes. A shaft with a hand wheel is also provided for hand traversing, and it is arranged that the hand and the power traverses cannot be engaged simultaneously. A manhole is provided on one side of the body of the loose headstock to allow access to its interior when required.

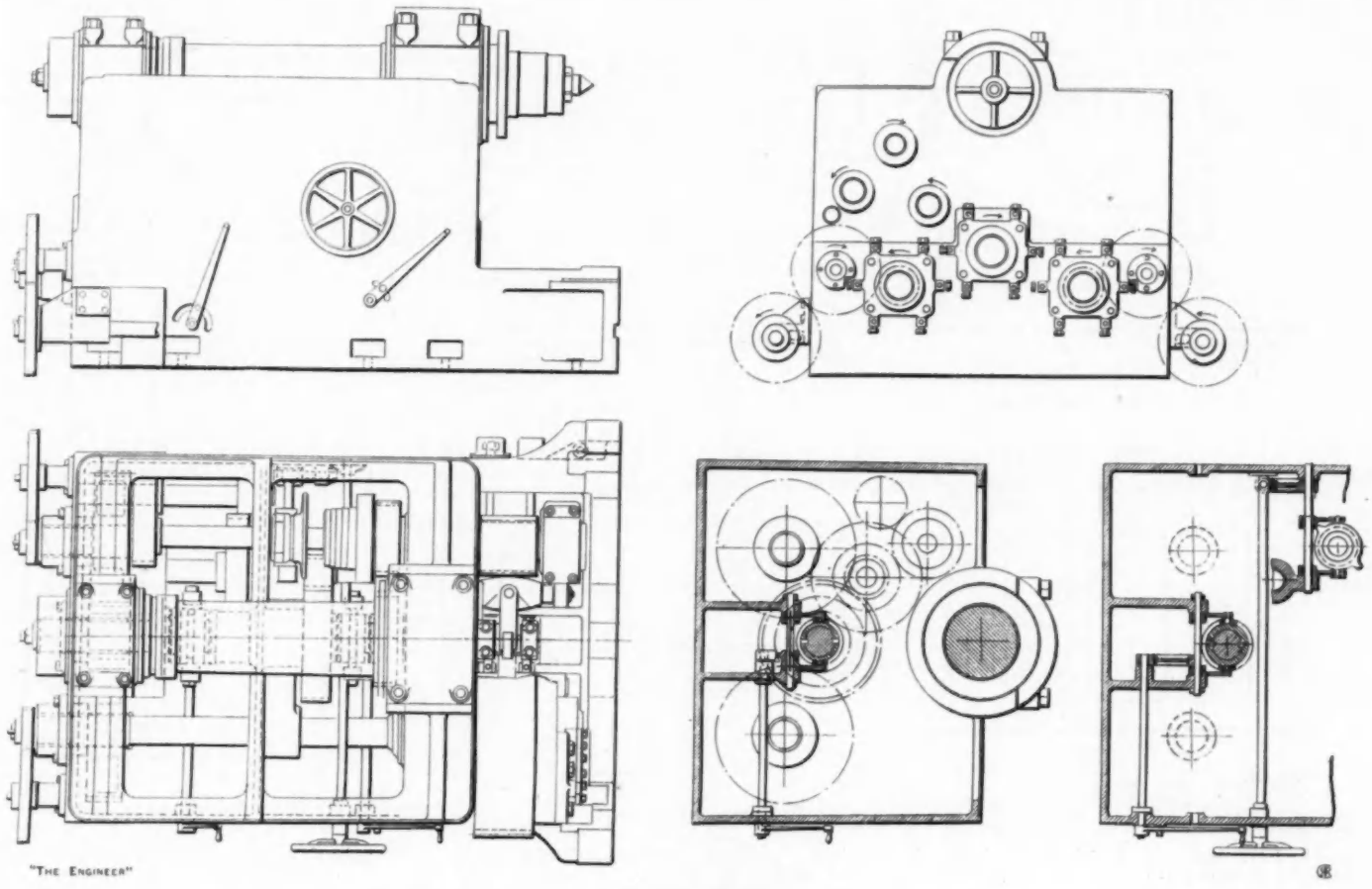
The loose headstock spindle is 13in. in diameter. It is bored for the reception of the thrust screw, which acts on a gun-metal nut within its end. The thrust screw can be employed to punch out the centre when required. The centre is of hardened steel ground to a conical angle of 90 deg. Within the spindle the centre is carried on two sets of roller bearings, spaced widely apart. Endwise pressure is taken on a ball thrust. These bearings are designed to carry the load imposed by one end of a 50-ton forged ingot running at 6 or 7 revolutions per minute, and being cut at 40ft. per minute.

The machine is equipped with four saddles, two at the front and two at the back. At the outer and inner shears wings extend from each side of each saddle to afford a wide bearing surface. The wings extending over the inner shear are, in the case of the rear saddles, provided with slips under both lips of the shear in order to take the upward lift on as large an effective surface as possible. The surfacing slides are in the form of box castings with circular tee grooves and sockets for the swivel slides on top. The swivel slides are also of box form and carry the upper end of the vertical feed shafts which drive the slide screws through clutches. The swivel slides can be swung round through a full circle and operate against bases marked in degrees. They carry intermediate slides on which the tool slides are supported. The tool slides are steel forgings machined all over and are furnished with clamping bolts and clamps to take tools, 3in. square, or a tool bar, 6in. square, between the bolts. The hand motion to the screws in the slides is communicated either by crank handles or ratchets.

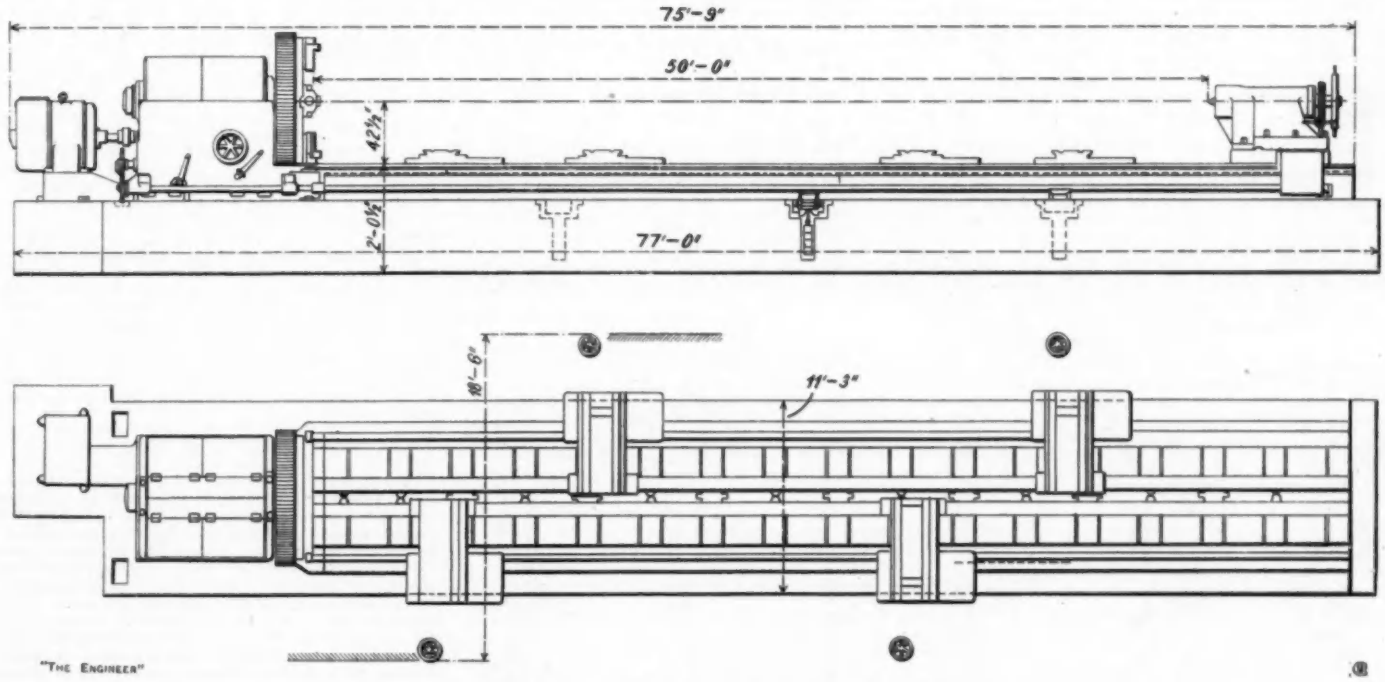
The saddle aprons are of box form, and are bolted to the underside of the saddles, thereby acting effectively as stiffeners. A large part of the front of each apron is made detachable for ready access to the interior. The feed shaft runs at several revolutions per revolution of the main spindle, and drives first through reversing gear and then through slip-on change wheels and worm reduction gearing. Thereafter, the drive may be directed, either for sliding, surfacing, or feeding the swivel slide. For traversing purposes a small motor is bolted on to the end of each apron. This motor drives on to the feed gearing inside the apron with, however, the reduction gearing cut out, and traverses the saddle at 20ft. per minute. Interlocking arrangements are provided to prevent the engagement of the power feeds or hand traverses when the quick power traverse is in action. The feed traverses are also arranged in such a way that the cross and longitudinal traverses cannot be engaged simultaneously.

For ease of operation, each apron carries a platform at a height of about 15in. from the floor level and furnished with a hand rail. At the outer side of each platform there is a hand wheel which, acting through cams, controls the engagement of the automatic feed and the hand or power traverses. A hand lever beside this hand wheel determines whether the sliding or surfacing motions shall be brought into action. The hand motions to the sliding and surfacing traverses are applied from a capstan on a vertical shaft in front of the operator.

The front and rear shafts extending along the full length of the bed are coupled close to the plane of the face plate to short stout shafts, which are driven through trains of spur gearing from extensions of the face plate pinion



DRIVING HEADSTOCK



ELEVATION AND PLAN OF 42IN. SHAFTING LATHE

shafts. The feed shafts are of large diameter with a relatively small keyway and transmit power through a hard gun-metal key to the sliding gear wheels in the aprons.

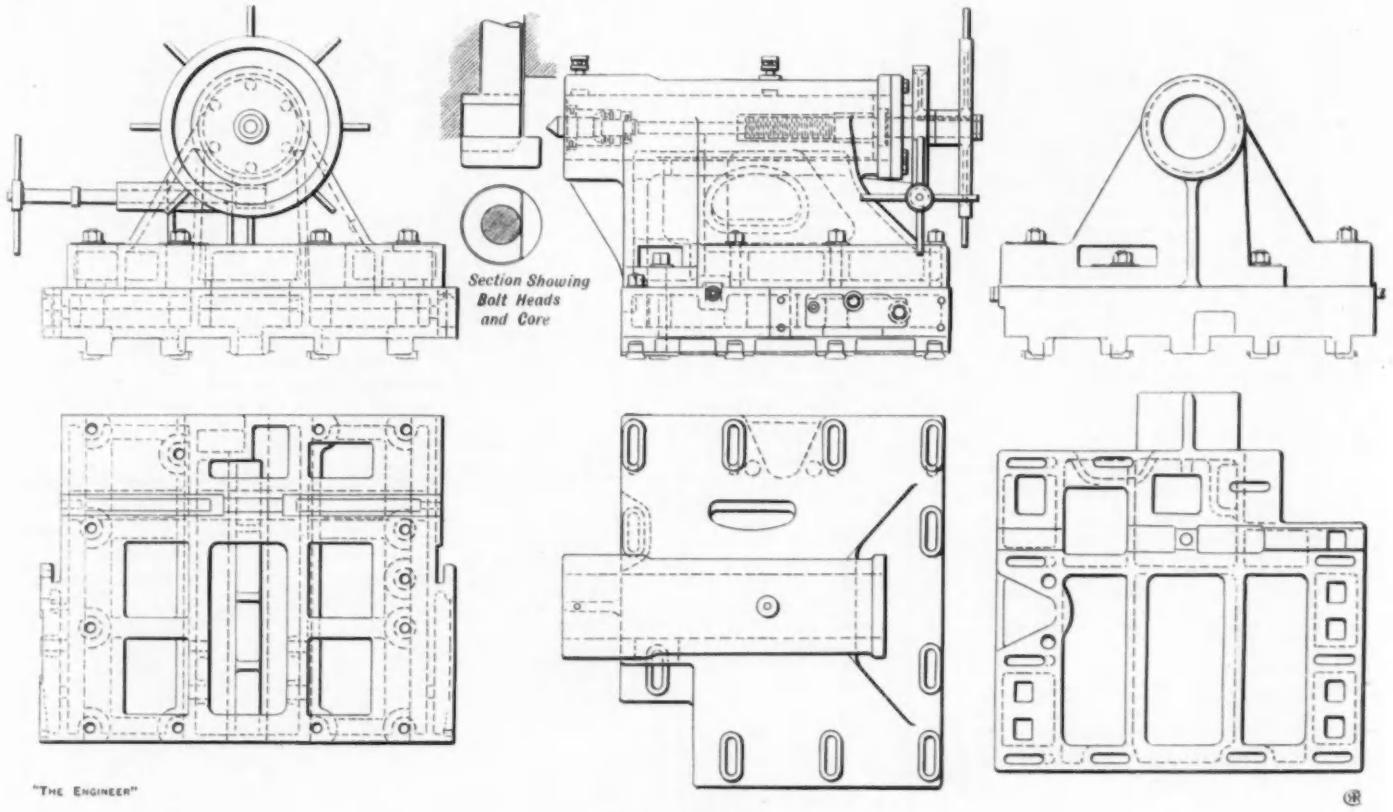
The four-point stay illustrated in one of the accompanying engravings has a range suitable for work extending from 14in. to 36in. in diameter. It is capable of carrying a deadweight of over 30 tons or of 24 tons revolving on its bearing pads. In the case of a light job it can take the lift produced by a cut of ¼in. by ¾in. The body of the stay extends across to the inner sides of the outer shears, and is guided by a narrow guide on the inner shears. The stay is held down on the bed by four bolts with L-shaped heads. The top portion is joggled into the lower portion, and is clamped by four hinged bolts, which permit speedy removal and replacement. The slides are of cast steel of flat section and have square edges which are guided in machined recesses in the face of the frame. Each slide is clamped by a sliding bolt and a stud bolt, so as to avoid the weakening effect of two long slots side by side in the slide or frame. The outer end of each screw is squared to receive a crank handle for rapid adjustment purposes. The collar at the inner end is made solid with the screw and is hexagonal in form to permit of a powerful adjustment by means of a screw wrench when the stay is under load. A hard gun-metal washer is placed under each collar, and the nut in the eye of each slide is of the same material. Each slide has a dove-tailed inner end for the receipt of gun-metal pads of various curvatures of face. One set of these pads is supplied with the lathe, the area being suitable for the bearing weights given above.

A roller stay is also provided. This stay can accommodate diameters ranging from 15in. to 60in. Its saddle extends across all four shears of the bed, and is guided and clamped in the same manner as the four-point stay. Two carriages slide in the saddle, each providing two cheeks for the roller gudgeons. The rollers are of chilled iron and are about 20in. in diameter by 5in. wide.

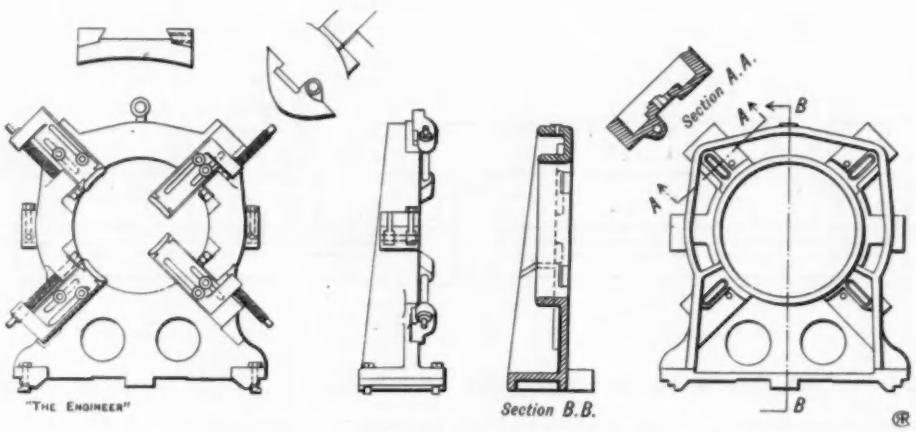
Some general data relating to this lathe are given in the table in the adjoining column.

Principal Dimensions.

Diameter swung over bed	84″
Diameter swung over saddles	66″
Length between centres	51′
Diameter of chuck	7′
Length of bed with headstock	68′ 7″
Width of bed	8′ 6″
Depth of bed	2′ 0½″
Front journal of spindle—	
Diameter	18″
Length	24″
Rear journal of spindle—	
Diameter	14″
Length	18″
Speeds of spindle	1·33 to 2·66 r.p.m.
	3·40 to 6·80 ,,
	8·35 to 16·70 ,,
	21·41 to 42·83 ,,
Feeds—	
Sliding	1/30″, 1/24″, 1/18″, 1/12″, 1/9″, 1/6″, 1/4″, 1/3″, 1/2″
Surfacing	1/45″, 1/36″, 1/27″, 1/18″, 2/27″, 1/9″, 1/6″, 2/9″, 1/3″
Swivel slide	1/63″, 1/54″, 1/40″, 1/27″, 1/20″, 2/27″, 1/9″, 4/27″, 2/9″
Horse-power of motor	160 B.H.P.
Floor space	75′ 9″ × 18′ 6″
Approximate weight	2466 cwt.



LOOSE HEADSTOCK



FOUR-POINT STAY

SIXTY YEARS AGO.

THE Navy Estimates submitted to the House of Commons on March 8th, 1869, by Mr. Childers, the First Lord of the Admiralty, in Mr. Gladstone's new Government, showed that when the ships under construction or planned were completed the British Navy would consist of 36 armoured broadside vessels carrying a total of 555 guns, 11 armoured turret or special ships carrying all told 43 guns, and an unarmoured fleet comprising 66 line-of-battle ships, frigates, corvettes and gunboats. In presenting this summary of the country's naval might, Mr. Childers pointed out that our maritime defensive and offensive power would in the future consist not only of ships and guns, but also of torpedoes, to the importance of which, he said, the naval authorities were fully alive. The only countries with which, apparently, it was necessary in those days to institute a comparison in the matter of naval strength were France and the United States. France, Mr. Childers stated, opposed 37 armoured vessels and 11 armoured floating batteries for harbour use to our 47 armoured vessels. The United States had no seagoing armoured vessels, but they had an immense fleet of such vessels available for defensive purposes. Of the new vessels to be built for the British Navy, three were to be turret ships. Two of these turret ships were to be of 4400 tons and of 5600 horse-power. They were to have double screws and four engines, and their speed was to be 12½ knots. Their freeboard was to be 4ft. 6in., and they were to carry four 25-ton guns. The base of their turrets was to be protected with a raised breastwork of oval form, 7ft. high. On the sides and breastworks the armour was to be 12in. and 10in. thick, the turrets were to be armoured with 14in. and 12in. plates, and the deck armouring was to consist of 2in. and 2½in. plates. They were to be without masts, so as to give the turrets an all round field of fire. They were to carry a crew of 250 officers and men. The cost of each was to be £286,000. Their draught, it was added, would be 25ft. to 26ft. The third turret vessel was described as a turret ram. It was to carry two 18-ton guns in a revolving turret and was to have a freeboard of only 1ft. 6in. The building of these turret vessels was severely criticised in Parliament and in our issue of March 12th, 1869. The grounds of criticism were provided principally by the fact that two turret vessels were then under construction in this country, the "Captain" by Laird Brothers at Birkenhead and the "Monarch" at Chatham, and that it was a mistaken policy to enter upon the construction of others until these vessels had been tested at sea. For long, the Admiralty—or, more precisely, Mr. Reed, the Chief Constructor, and Admiral Robinson, the Controller of the Navy—had been violently opposed to the building of turret ships. Mr. Childers' statement on the Estimates of 1869, therefore, revealed a notable change of view. That the Admiralty was preparing to build three more turret ships before the "Captain" and the "Monarch" had been completed, seems to disprove the statement on the memorial tablet in St. Paul's Cathedral to the 482 officers and men who perished when the "Captain" capsized in 1870, that that vessel was built "under the pressure of public opinion."

A SHORT note in *Mechanical Engineering*, the monthly journal published by the American Society of Mechanical Engineers, attracts attention to the necessity for the highest quality of riveting for high-pressure boilers. It is pointed out that the ordinary boiler rivet is likely to have die marks and fins under the head and along the shank. It is apt to be out of round, to have small rolling seams, and to be coated with a forging scale. Any one of these conditions will cause trouble sooner or later under the action of high working pressures, and the specifications should be so written as to preclude their presence. In keeping with modern advanced design, rivets should be produced by a forging process and treated to remove all scale, fins, seams, and die marks. The shanks should be accurately round and fitted into carefully reamed holes with a clearance of no more than one thirty-second of an inch. A full metal-to-metal contact between the rivet and the plate is necessary for tight work, and such a result can be accomplished only by the use of a clean perfectly formed rivet. The control of this factor in the manner indicated will furnish a warranty for prolonged satisfactory performance, because the vessel fabricated in such a manner will equal the designer's expectation of a solid one-piece unit of uniform strength that depreciates no faster at one place than another.

Railway and Road Matters.

THE Great Western Railway Company has now imitated its smaller neighbours, the Metropolitan and the Metropolitan District, in providing fog-repeaters for the signals on the main and relief lines between Paddington and Old Oak Common.

THE Algoma Steel Corporation of Lake Superior has completed rolling a special order for the Canadian National Railways, consisting of several thousand tons of intermediate manganese rails. This is the first time that rails of this character have been made in Canada.

THE electrification of the Swansea and Mumbles Railway—the subject of a note in our Seven-Day Journal on September 23rd last—was inspected, on behalf of the Ministry of Transport, by Colonel Trench, on February 26th, and opened for public traffic on March 2nd.

A FATAL collision occurred at the north end of Darlington Station on the evening of Saturday, March 9th. The night train from Newcastle to Sheffield, Oxford and Bournemouth ran into a light engine. The two leading vans were telescoped and the guard killed. The fireman of the light engine subsequently died from his injuries.

THE programme of the Canadian National Railways for the construction of new branch lines to be built within the next three years, as finally arranged to be submitted to Parliament for its sanction, includes a total length of 695 miles mainly in Eastern Canada. Some of these branch lines will open up important agricultural areas, while others, by linking up existing lines, will afford economic and operative advantages to the system. The longest of the lines proposed will run for 117 miles from Walburg, Sask., to Bonnyville, Alberta. Another 86 miles long, from Melfort to Aberdeen, Sask., will furnish a direct route to the Pas Man and the copper-mining area of Northern Manitoba. In Ontario the mining district of Sudbury will be served by extensions to two existing branch lines.

THE large marshalling yard of the London and North-Eastern Railway at Whitemoor, near March, to which reference was made on page 56 of THE ENGINEER of January 11th last, is now nearly completed, and most of it was brought into use recently. It lies in the angle between the Doncaster and Wisbech lines, and is entered by facing points off the up Doncaster line, where arriving trains are at once received in one of ten reception roads, each of which holds eighty wagons. South of those roads is the hump for gravitational shunting, the descending side of which is laid on a gradient of 1 in 18. The wagons of arriving trains are sorted there into four groups of sidings; ten sidings are in each group, and they have accommodation for 3679 wagons. The newly-formed trains that are made up in the sidings leave by one or other of two departure roads, which join the Wisbech line at a point just north of the junction between the Doncaster and Wisbech lines. Hydraulically-operated retarders are provided immediately inside each group to check the speed of the wagons, and the points for entering the groups and the sidings are operated electrically. Flood-lighting is employed for night operations.

IN our last two annual articles on Railways reference was made to the joining up of the Victoria and Exchange Stations at Manchester of the London, Midland and Scottish Railway. In connection with that work the whole of the signalling is being rearranged and being operated by the all-electric system of the Westinghouse Brake and Saxby Signal Company. All the running signals will be of the day colour-light type, which, like those in the London area of the Southern Railway, will give indications, by red, green, single yellow and double yellow, by day as well as by night. These power-operated signal-boxes will replace seven mechanically-operated, and the total of 352 levers in the latter boxes will be substituted by 217 levers in three frames of 95, 107 and 15 levers respectively. In an allusion to this work, in its issue of March 9th, the *Manchester Guardian* said that "Manchester is the first place in the north to have these light signals." That is hardly so, as the Liverpool Overhead Railway was equipped with them in 1921. Moreover, that was the initial installation of light signals in this country, and it led to the appointment of the Departmental Committee of that year which expressed approval of their substitution for semaphore signals. There are, however, no cautionary signals on the Liverpool Overhead, and, therefore, no single or double yellow lights.

THE report for the year ended March 31st, 1928, of the South African Railways, says that the electrified section of the Natal main line is working efficiently, and no difficulty has been experienced during the year under review in meeting all traffic requirements. Considered, however, from the standpoint of economical working, the financial results are not so satisfactory. The earlier expectations of increased traffic have, unfortunately, not been fully realised, in consequence of which the installation has not had to work at full capacity, and the financial results of operation have suffered. Experience with the system shows that although electrification is undoubtedly an extremely efficient means of transport, the capital outlay is so enormous that only under the most favourable conditions of intensive traffic is there any prospect of meeting the additional cost in interest and other charges which the adoption of electric traction entails. It is being urged in certain quarters that the administration should proceed with the electrification of the Durban-Pietermaritzburg section. It is pointed out that the electric current required for traction purposes could be supplied from the newly erected power station at Congella, and that the increased output from that station, in consequence of the traction load, would probably result in decreased charges for domestic and industrial supplies of electricity. The heavy capital outlay and addition to the working costs which electrification involves make it impossible for the general manager to recommend any extension of the electrified system at the present time. The necessity for the more expeditious transit of traffic between Durban and Pietermaritzburg is appreciated, but that, in the opinion of the general manager, can be as efficiently and more economically obtained under present conditions through the medium of steam locomotives of high tractive power and by doubling the line where necessary.

Notes and Memoranda.

AT Middletown, Ohio, the American Rolling Mill Company is transporting molten pig iron a distance of 10 miles in 150-ton ladles. The ladles are handled on a private railway and are tapped into 50-ton ladles, which take the iron to the open-hearth furnaces.

THE use of echo-sounding apparatus, which was used for locating enemy submarines, is, according to Rear-Admiral H. P. Douglas, increasing rapidly in our fishing fleets. The apparatus is used to find the position of the banks where fish may be expected.

A REPORT, published by the American Bureau of Mines, by Messrs. D. Harrington and F. E. Cash, states that the cost of applying a mud of soil and water to the workings of coal mines, for the purpose of allaying explosions, amounts to from 1½ to 2 cents per square foot.

IN the public libraries of Newark, Cleveland, Bridgeport, Baltimore and the John Crerar Library, Chicago, there is an Engineering Index Service, instituted in January, 1928, which indexes 1700 journals. We are informed that THE ENGINEER is fully indexed on cards week by week as it appears.

A GLOBE steam valve, 1¼in. in diameter, "exploded" on board of a dredger, according to a recent Board of Trade report. As a matter of fact, its bonnet was unscrewed from the body by the combined action of a passing hawser and the effort necessary to open the valve. Obviously, the valve should have been provided with a locking device to prevent the bonnet slacking off.

A RATHER unusual type of boiler blowdown-pipe explosion on board a steam trawler is described in a recent official report. Fortunately, no one was hurt thereby. A reasonable arrangement of piping was provided, but after the explosion it was found that the pipe on the discharge side of the blowdown cock had been so scoured away by the solid matter carried by the water discharged from the boiler, that it was unable to withstand the pressure. The cock also was rather inaccessible, and, as a consequence, the boiler had to be allowed to empty itself, and the vessel was towed home.

SULPHUR is not known to be definitely toxic to wood-destroying agencies, according to Mr. E. F. English, of the Forest Department, Pretoria. It seems likely, however, that even a mildly abrasive material might be repellent to termites and wood borers. It is possible also that its slight odour might have a repellent effect. Under ordinary conditions wood impregnated with sulphur would have great permanence. The only agency likely to cause loss of sulphur from treated wood at any appreciable rate would be bacterial oxidation in the soil. As a poor conductor of heat and electricity, sulphur would impart useful properties to wood treated with it. The appearance of sulphur-treated wood is good.

THE laying of the longest submarine telephone cable in the world—between Sweden and Finland, connecting Stockholm with Aabo—has just been completed. The whole cable distance is 242 kiloms., of which 212 kiloms. length is marine cable, the total weight being 2000 tons. The thickness of the cable is 45 mm. on the Swedish side and 50 mm. on the Finnish side. It contains thirty-two copper wires, spun together four and four into eight four-wire conductors. Seven of these are intended for an equal number of calls on the four-wire principle between Sweden and Finland, the eighth trunk permitting two calls on the two-wire principle between Aaland and the mainlands of Finland and Sweden.

ACCORDING to Messrs. L. F. Bates and R. C. Brown, Monel metal made from a natural ore found in Ontario, is an alloy of 67 per cent. nickel, 28 per cent. copper, and 5 per cent. of other metals. It shows great resistance to corrosion. While it is ferro-magnetic, its critical point is unusually low. It may conveniently be used for a laboratory experiment to illustrate the loss of ferro-magnetism with rise of temperature. The magnetic critical temperature varies from specimen to specimen, and is stated to lie between 100 deg. and 150 deg. Cent. This appears to apply to specimens in the form of the stout bars supplied commercially, but specimens in the form of anchor rings of diameter 10 cm. and 1 cm. thickness supplied to the authors possessed critical temperatures of 70 deg. Cent.

PROFESSOR FRANZ FISCHER, of the Coal Research Institute at Mulheim-Ruhr, has published the results of his recent investigations on the transformation of methane into higher hydro-carbons. He has found, says the *Chemical Trade Journal*, that below 900 deg. Cent. there is no appreciable decomposition of methane, whilst at a temperature of 1200 deg. Cent. the reaction proceeds too far. The use of catalysts does not seem to favour the decomposition of methane. The best method seems to be to carry out the initial stages of the decomposition under diminished pressure, and then, in the final stages under positive pressure. The light oil produced consists, as to half, of benzine. Work is proceeding in the attempt to find a process for the conversion making use of one stage only and ordinary pressures.

THERE are some pertinent remarks in a recent official report on the explosion of a boiler on one of the Scottish islands, which resulted in the death of the attendant. The Surveyor explains that the boiler, one of the Cornish type, was thirty-five years old, but was worked on an average only one day in a fortnight. It failed through the corrosive wasting of its shell. He says that "it appears desirable to note and comment on certain salient features of this case as follows:—Mr. Thom had no special knowledge of boilers, but he had informed himself about them sufficiently to know that they 'wear out' with increasing age and that a serious explosion could occur as a result. Further, that a boiler, which to all appearances was sound, should, nevertheless, be regarded with suspicion until such parts as are ordinarily hidden from view had been exposed and a thorough examination made. It was because of this knowledge that he determined to have the condition of the boiler ascertained, and in this way he can be said to have had a proper appreciation of his responsibility as a boiler owner." Unfortunately, the man whom he employed was not, apparently, competent, and he consequently lost his life.

Miscellanea.

A 10-TON luffing crane is to be installed at the L.N.E.R. dock at Bo'ness.

SOME promising deposits of cobalt ore are said to have been discovered in the Eastern Transvaal.

A DISCOVERY of amethyst quartz has been made a few miles from Johannesburg, on the Pretoria road.

A COMPANY with a capital of £40,000, is being organised in the Fukien Province of China, for the development of commercial aviation.

A COAL dock, which is to cost 420,000 dollars, is to be built at Michipicoten Harbour, Ontario. The equipment is to be made in Canada.

THE newsprint mill of the Mersey Paper Company, Liverpool, Nova Scotia, is to be increased from a capacity of 250 tons to 375 tons a day.

THE exports of nickel from Canada during January amounted to 11,508,200 lb., which is approximately double the amount for January of 1928.

THE Canadian Government has authorised the Beauharnois Power Company's scheme for the development of power from the waters of the St. Lawrence.

A SCHEME involving the expenditure of £49,980 on bridge building and lock improvement on the upper reaches of the river has been approved by the Thames Conservancy.

A SECOND 220,000-volt transmission line, 226 miles long, is to be constructed between Paugan Falls, on the Gatineau River, Ontario, and Toronto. The cost will be about 3,000,000 dollars.

THE Chinese Government has decided that the metre shall be henceforth the standard measure of length. It is to be called the "standard foot," and one-third of its length will be a "market foot."

A CONTRACT for the delivery of 2000 tons of zinc ore per month from the Lusaka Mine, Northern Rhodesia, has been arranged. The question of laying down a plant for the production of metallic zinc at the mine is being considered.

THE output of the by-product coke ovens of the United States last year was 48,205,577 tons, which represents an increase of 9·8 per cent. over 1927. The production of beehive oven coke, however, dropped by 39·3 per cent. to a total of 4,376,000 tons.

A COPPER refinery is to be put up on a site near Quebec, at a cost of 3,000,000 dollars. It will take its supplies of ore from the Noranda mines and will require some 20,000 H.P. of electric power. The output will be from 100,000,000 lb. of crude copper a year.

Now that an agreement has been reached between the Union Manganese Mines and Minerals, Ltd., of South Africa, and a British financial group, the actual starting of an important industry is said to depend upon the settlement of the railway question.

DURING the calendar year ended December 31st, 1928, a total of 6334 commercial vessels, paying tolls aggregating 26,375,962·41 dollars, passed through the Panama Canal. The daily average number of transits for the year was 17·31 and the daily average tolls collection 72,065·46 dollars.

THE International Nickel Company of Canada will enlarge its refinery at Port Colbourne, so as to provide three additional electrolytic units, at an estimated cost of 1,500,000 dollars. The Standard Steel Construction Company of Port Robinson, Ont., has been awarded the contract for the steel construction required.

THE proposals of the South Indian Railway as to electrification include the supply of electric power to the Golden Rock workshops and the follwoing lines:—Ootacamund to Mettupalayam, Mettupalayam to Podanur, Podanur to Dindigul, Podanur to Erode and Trichinopoly to Tanjore. It is proposed to draw the necessary power from the Pykara project.

A NEW department is, according to the *Iron and Coal Trades' Review*, to be opened at the University of Sheffield for the cold working of steel. A research fellow and two research scholars are to be appointed by the University to form the nucleus of a staff to assist Sheffield industrialists in perfecting the manufacture of cold-worked steel. This has been made possible by the generosity of the Worshipful Company of Ironmongers and manufacturers who have made contributions through the Cutlers' Company, of Sheffield.

TENDERS will be called shortly for the construction of the new Canadian national research laboratory at a cost of not less than 2,000,000 dollars. Plans of the laboratory have been approved and construction operations are expected to start by May 1st, and to be completed by September 30th, 1930. The new building, which is to be classical in design, will be 420ft. long and 150ft. deep. It will be erected on property overlooking the Ottawa River, near the Rideau Falls. In addition to being equipped with research laboratories for industrial chemistry, engineering physics, industrial engineering, textiles, and economic biology, provision is also made for studying methods for improving the processes of manufacture and for the solution of special problems arising from the development of the natural resources of Canada.

IT was announced by Premier MacKenzie King in the Canadian House of Commons on February 26th, that, to enable the resumption of negotiations with the United States with regard to the St. Lawrence waterway project, a conference would be called at the close of the session between representatives of the Dominion and the Provinces of Ontario and Quebec. The dispute which arose as to the ownership of the water powers to be created by the project, delayed the negotiations for the time being, and an appeal to the Supreme Court left the question still unsettled. If a satisfactory arrangement of the dispute can be effected by an agreement between the Dominion and the Provinces, the way will be clear for the reopening of the negotiations. The Premier stated that no treaty would be finally negotiated with the United States until Parliament had ratified every clause.

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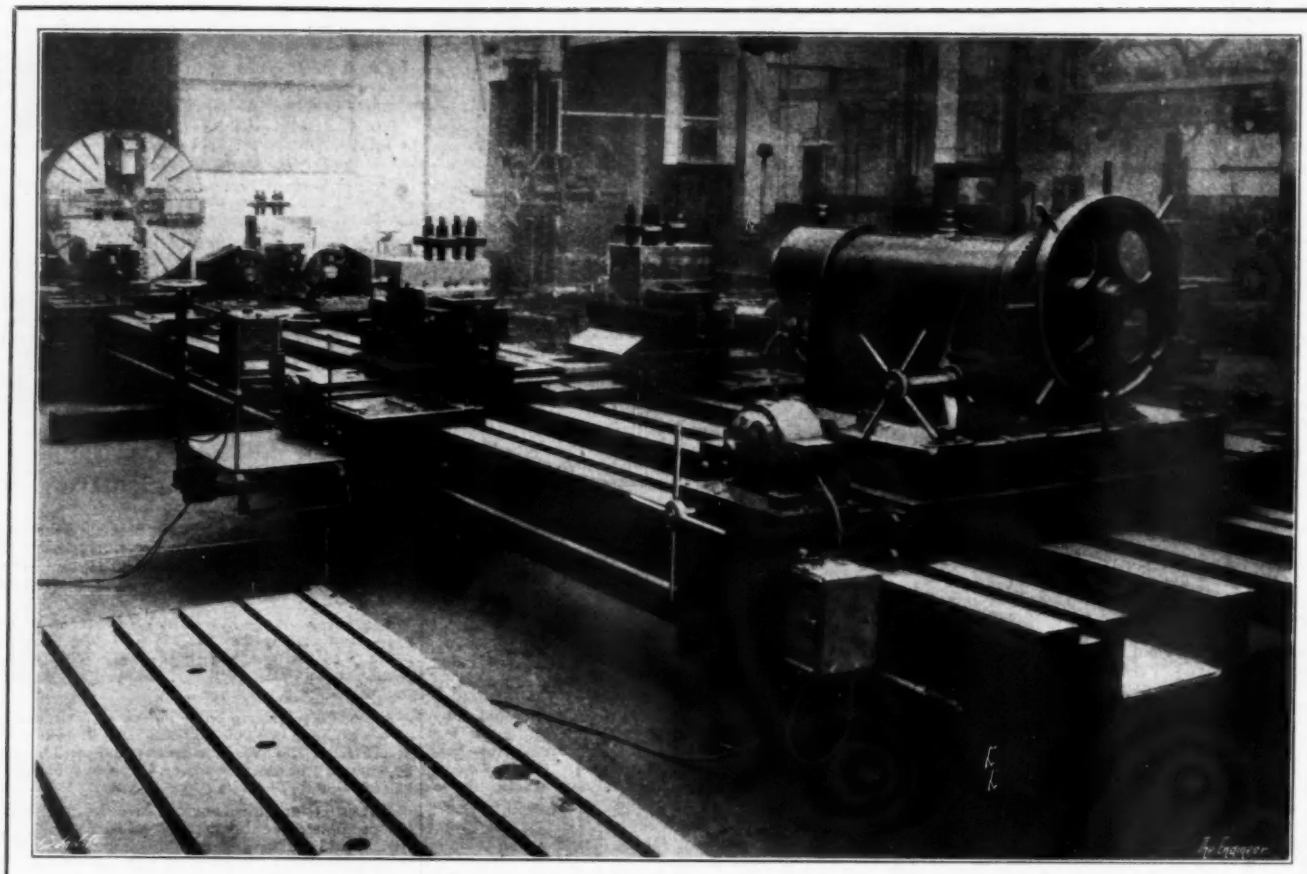

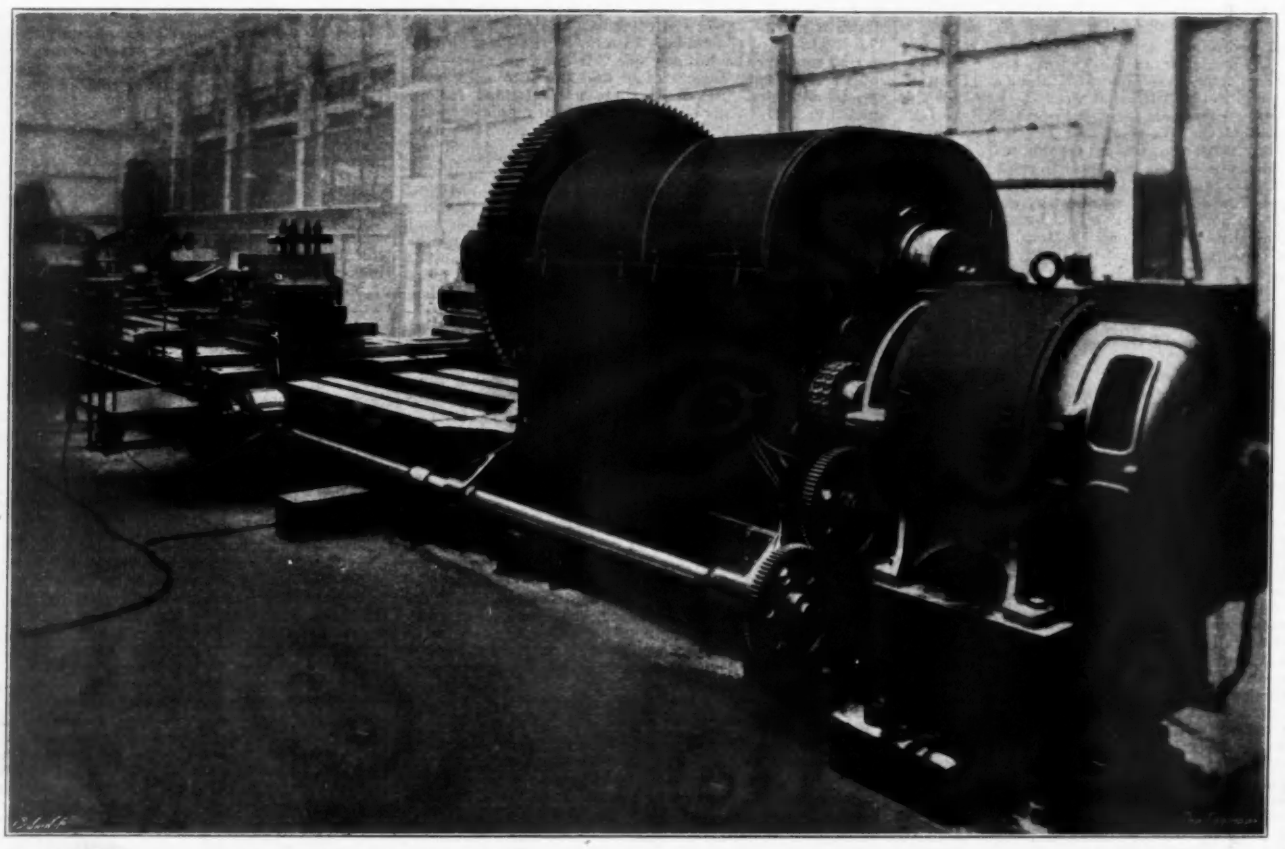

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THE ENGINEER.

MARCH 15, 1929.

Trade Within the Empire.

THE final report of the Committee on Industry and Trade—familiarly known as the Balfour Committee—which was issued on Monday last, brings to an end a work which is almost without parallel. The undertaking was a tremendous one. It involved an inquiry into all the industries of the country, and from all points of view, with "special reference to the export trade." The Committee has held no less than one hundred and thirty-six meetings, and the list of witnesses occupies five pages of type. It was appointed in 1924, and it has issued six specialised reports of large dimensions, the present making the seventh and concluding volume of a very remarkable series. There is a broad hint that the Committee remains in existence, and will continue the work it has begun, and it itself suggests that a permanent body, charged with the periodical publication of reviews of the industrial position, should be set up. The reports without exception have been very well prepared, and the final one, in which broader views are taken, is a veritable text-book of the industrial economics of an island kingdom, parent of an Empire. They have but a single defect; a defect inseparable from the work of a Committee of rather large dimensions selected with the deliberate intention of avoiding bias. The defect is that every debatable subject is presented as a compromise. For perfect definition of vision, it is imperative that one eye should be shut; but when there is an outward squint and one eye may be looking at one thing and the other eye at another, the effort to co-ordinate vision leads to uncertainty of aim. That is the one fault of this admirable report. One wishes sometimes that the Committee had been less anxious to preserve strict impartiality, that it had not always seen both sides of the question, and that when it had adduced what appeared to be conclusive arguments, it had not opened, as it so often does, the very next paragraph with "Nevertheless."

It would be fruitless to attempt to give a comprehensive review of a volume which runs into well over three hundred pages, on every page of which there is some useful concentration of the essence of evidence secured by the Committee. We shall therefore turn our attention to a single subject, Trade within the Empire, but on another page we reprint the Committee's "Conclusion," and we very earnestly invite our readers to study it. When they have done so they will, no doubt, turn to the body of the report which, apart from its intrinsic value, is, we may add, very readable. The most obvious of the devices for the encouragement of inter-Imperial commerce is the erection of tariff walls, high against foreigners and low against the members of the Empire. Such preferential tariffs already exist, and there are many who hold that an extension of them is the only solution of the trouble of the home industries. They will, we fear, find small comfort in the report. Broadly speaking, it might be described as a Free Trade document. If it were not for the inevitable "Nevertheless" to which we have referred, it would, be an out-and-out opponent of any tariffs, except those required to provide revenue. It is clearly no friend of the tariff which is set up in order that one country may have something to negotiate with in its dealings with other countries. "We can," says the Committee, "the more unreservedly concur in the condemnation of tariff bargaining on the continental model, because neither the principles on which the present British Customs tariff is framed, nor those advocated by any of the trade witnesses who have given evidence before us, would admit of Great Britain adopting the continental procedure as a normal method of tariff construction." The reformer may retort, "So much the worse for the principles," but as, by general agreement, it is admitted that the stability, the immutability of a tariff, is of the first importance, even he would not lightly venture upon a scheme under one Government which might be overthrown by the next because it was opposed to the long-established principles of the country. To carry the matter a stage further we quote another sentence: "The idea of definite reciprocal tariff bargains between Great Britain and other Empire Governments, fixing the terms on which inter-Imperial trade should be carried on, is quite alien to the modern spirit and practice of Imperial preference." There are, in fact, insuperable difficulties in the way of compensating the Dominions *in kind* for the preference accorded them by British manufactures. The Committee goes on to say: "We are under no illusion that any such extension of preferences as is practicable . . . can, taken by itself, confer benefits on Empire products equivalent to those which British manufactures enjoy in Empire markets through the operation of Dominion and colonial preferences." In other words, the establishment of a tariff wall here would not have the desired effect of encouraging inter-Imperial commerce. There is, of course, a "Nevertheless" to this conclusion: "Nevertheless, the aim of reciprocating Dominion preference by all suitable means which are consistent with the essential interests of the population of Great Britain is one which, in our judgment, should be regarded as a necessary qualification of the normal 'type' of British tariff policy, even if it cannot be the basis of that policy." This is rather like a *douceur* thrown to the Protectionists, and, we submit, is hardly as convincing as the condemnation of a "general" tariff. But even on the question of safeguarding particular interests, the Committee is far less satisfied than the supporters of that scheme. After a careful inquiry, it has reached the conclusion that the data available in connection with the McKenna Duties do not "enable any general and definite statement to be made with any confidence as to the results of their incidence." We ourselves have always felt a similar doubt and are interested to note the conclusions of the Committee.

There are, we suppose, very few economists in this country who do not realise that a trade convention, embracing all parts of the Empire, would not only be of the greatest service to the industries of the United Kingdom, but may be the only method of saving them from dwindling away till they can just satisfy the requirements of a much decreased population. To all such it must come as a disappointment to find that a great Committee, after arduous labours, has come to the conclusion that the selected corner stone of the edifice they visualise is no more than crumbling sand. They will naturally ask, "Has the Balfour Committee nothing else to recommend? Its criticism so far is destructive, is it not also constructive?" In a sense it is, but mainly by appeal to incorporeal things, to Imperial sentiment and

to gratitude. Gratitude for the undeniable services that the United Kingdom renders to all the Dominions and Colonies, and the sentiment of the common blood. "The whole question of Imperial economic relations would be raised to a higher plane if it were generally recognised that, within the family of states constituting the British Commonwealth, it is the duty and interest of each state, subject always to the safeguarding of its own essential economic life, to do everything possible, without reference to any exact bargaining equivalence, to promote the prosperity of the Commonwealth as a whole." That does not take us very much further than we have been for years past, but if it shows more clearly the only way, and helps to remove the common illusion that we can build up trade within the Empire by mechanical means, it may serve a useful purpose. Trade with our Dominions is to be maintained and extended as with any other market overseas. We must put our own house in order. There must be, as the Report has it, "an active *will* to reorganise," and a *power* to reorganise "based on adequate means of access to the financial and technical resources necessary for material equipment, together with the whole-hearted co-operation of all the human factors to ensure that the best results shall be obtained from the transformation." Given these two requisites and combining with them the proud integrity of British commercial dealings, we shall see not only foreign trade restored, but inter-Imperial trade developed on the sure, non-artificial basis of mutual service.

International Trade in Agricultural Machinery.

ANYONE who has made a recent tour of the English works devoted to the manufacture of agricultural machinery will be familiar with the decline of that once-prosperous industry, and will have noticed that the long trains of implements and machines which used to leave the shops, principally of East Anglia, no longer pass along the railways to our ports. They will probably have been told that this state of affairs has been brought about primarily, by the loss of the Russian trade, and, secondarily, by the incursions of other manufacturers who have been supported by banking concerns more willing to finance trade than are the English banks. Should they, however, wish to confirm those impressions by a review of the "Survey of the Trade in Agricultural Machinery," just issued by the Imperial Economic Committee, they will be disappointed.

In this report an attempt is made to survey the export trade in agricultural machinery of the United Kingdom, Canada, the United States, and Germany. At the outset, the investigators were faced with great difficulties, in making any detailed comparisons, on account of the fact that the systems of classification adopted by the different countries vary widely. Thus, the United Kingdom returns divide the exports of agricultural machinery — excluding tractors—into nine sub-heads, among which "grass and lawn mowers" are classed together, whilst the sub-head of "other descriptions" covers a range of apparatus so widely diverse as harrows and portable engines. Again, the German returns group together little mowing machines with big reapers and binders. The American and Canadian returns are certainly better in this respect, but even in them some quaint anomalies exist. Another example may be given to show the same effect. The United Kingdom exported to the Irish Free State "ploughs and parts" to the value of £139,000 f.o.b. in three years. During the same period the imports of "ploughs" into the Free State is recorded to have been only £25,300 c.i.f. Added to all this the reporters have deliberately excluded from their survey all agricultural hand tools, such as spades, hoes, rakes, &c., which provide an important industry for the Midlands. Hence the report is very confusing, but one fact stands out prominently. It is that while our share of the world's export trade in agricultural machinery, including tractors and dairy machinery, amounts to only one and a-half million pounds sterling a year, that of Germany is worth nearly three millions, of Canada three and a-half millions, and of the United States eight and a-half millions. It is also noteworthy that the exports for 1927, which is the latest year included in the report, are practically similar to those of 1913 in the case of England and Germany, whilst the exports from the United States rose slightly, and those from Canada were more than doubled, as compared with 1913. In view of the great expansion of agriculture in those two countries within recent years, these facts suggest that the machinery industries there must be in a prosperous condition. In these circumstances, it is not surprising to find that in no country do we get a predominant share of the import trade. In Russia, where we were once supreme, we now have only 1·4 per cent. of the trade, while Germany gets 75·8 per cent. Even in Australia, New Zealand, South Africa, and India, we have only 21·2 per cent., Canada has 35·0 per cent., the United States 38·9 per cent., and Germany 4·9 per cent. The greatest proportion of our output goes to "Other countries," which take 24·3 per cent., but even in them we are beaten by the United States with 50·7 per cent. It is noteworthy, in view of the large amount of British money invested in South America, that our share of the trade with that country amounts to only 3·8 per cent. It appears that Argentina is, however, the best market for agricultural machinery. There the imports amount to about four million pounds a year. Canada comes next with two millions, Russia and France require a million pounds worth a year each, and the United States, Australia, British South Africa, and Italy each half a million. Our trade with South America is improving slightly, but it has not recovered to the same level as the average for 1911–13. On the other hand, the United States trade with South America is on the decline, but is still much above the previous average, and is double our share. Canada exports a very large proportion of her production to the United States.

All these facts confirm what is, of course, obvious —that the conditions of agriculture in the world are changing. Whereas in the past much agricultural produce was raised on comparatively small holdings, now vast tracts of virgin land are being brought under cultivation on a grand scale. The English business of implement manufacture was developed long after small farming had been established, and, naturally, had to be adapted to existing conditions. On the other hand, the Canadian and American factories grew up contemporaneously with local agriculture, and were planned appropriately. In fact, it may almost be said that those factories have dictated the systems of farming. In the circumstances, it is only natural that they should secure the export trade to countries employing similar agricultural practices. As to the English industry, it would seem that there is little prospect of its securing much of the new export trade, as the outlay required to set up in competition with the factories abroad would be prohibitive. Neither have we the facilities for experimental work. There is, however, a brighter side of the picture. Machinery in general is certainly becoming much more popular with farmers in general, and the trade in tractors alone is already important. There is also another outlet in the huge areas of India and China, where the scale of operations is more commensurable with those of England. The processes of agriculture there are, of course, quite dissimilar from those of temperate climates. Nevertheless, it would seem that our factories would be readily adaptable to the production of implements suitable to local requirements if the conservatism of the users could be overcome. There is already some indication of such a change in the increasing use of centrifugal pumps in China for irrigation purposes. The extent of these markets needs no emphasis.

Obituary.

ALBERT CHARLES PAIN.

WE regret to have to put on record the death of Mr. A. C. Pain, M.I. Mech. E., which took place on Thursday, March 7th. Mr. Pain was widely known in connection with the design and lubrication of high-speed steam engines.

Albert Charles Pain was born at Micheldever, in Hampshire, on March 23rd, 1856. He had, therefore, nearly completed his seventy-third year. He was educated at Cranleigh and Clewer House Schools, and was apprenticed in 1873 at the works of Day, Summers and Co., where he served for four years. When out of his time he signed on in the engine-room of a screw collier, and it was while so engaged that he had an experience which eventually led him to invent the method of forced lubrication with which his name is especially associated. The vessel in which he was serving as third engineer was engaged in carrying coal to the British Fleet, then in the Eastern Mediterranean. She had been lying up for some time in home waters and was in anything but first-class condition. From the outset there was a very heavy knock on the bottom end bearing of the high-pressure connecting-rod. During the voyage the second engineer demonstrated to Pain how to stop, or at any rate to mitigate, that knock for the time being. What he did was simply to pour a liberal supply of oil down the lubricating pipe leading to the bearing, so that the latter was flooded. The noise lessened at once and then nearly disappeared. It was quite an ordinary thing to do, and it would probably have been done by nine hundred and ninety-nine engineers out of every thousand when they heard a noise and traced it to its source. It was not every engineer, however, who could evolve from that experience a system of keeping bearings plentifully supplied with oil under pressure so as to fill up the voids and take up the slack in them. Yet that is what Pain eventually did. The germ of the idea of what was required entered the brain of the young man when he saw the result of pouring into the bearing that flood of oil, but it was to be a good many years before he saw his way to solve the problem of how to do what was necessary, automatically.

On his return to this country after his trip in the collier, Pain managed to get work in the drawing-office at Portsmouth Dockyard, where he remained for six years, from 1878 to 1884. It was there that he came into contact with the late Mr. Alfred Morcom, who was for a time first assistant to the Chief Engineer, and who was favourably impressed with the abilities of the young draughtsman.

Now, it happened that in 1884 Mr. Morcom, who in the meanwhile had left Portsmouth to become Chief Engineer at Sheerness Dockyard, severed his connection with the Navy in order to join in partnership with Mr. G. E. Belliss, who had built up a successful business at the Ledsam-street Works, Birmingham, in the construction of high-speed steam engines, many of which, in collaboration with Mr. White, of Cowes, he had fitted with excellent results in Admiralty launches and similar craft. Apparently, very shortly after he went to Birmingham, Mr.

ALBERT CHARLES PAIN

Morcom invited Pain to become chief draughtsman to G. E. Belliss and Co., which was the name of the firm at that time. Pain accepted the invitation, and the remainder of his life was spent at the Ledsam-street Works.

The association of the three men constituted a happy and most successful combination. All three "knew their job," and the result was that a period of great development ensued. Large numbers of engines of different types and increasing size were manufactured. Pain's first work was to design the complete main and auxiliary machinery and boilers for torpedo boats. Later vessels equipped were the gunboats "Swordfish," "Spitfire," "Sharpshooter," "Spanker," "Boomerang," and "Karakatta."

During his career in Birmingham—a period of nearly forty-five years—Mr. Pain was responsible for the design of some 8500 high-speed engines in sizes ranging up to 2500 B.H.P., and of over 2000 reciprocating compressors in units up to 7000 cubic feet of free air per minute compressed to 100 lb. per square inch. He also designed some special compressors for pressures up to 6000 lb. per square inch. These machines represented, in all, a total of some two and a-half million horse-power.

It is perhaps somewhat extraordinary that Mr. Pain was as long as he was in working out his system of forced lubrication. It was in 1878 that he had seen the "knocking" of a bearing reduced by flooding with oil. But it was not till twelve years later—in 1890—that he took out his famous patent for forced lubrication. The patent is numbered 7397 of that year, and is for "an improved system of Lubricating the Working Parts of Steam and other Engines." As a matter of fact, the invention is extremely simple, which makes it all the more to be wondered at that no one had thought of the invention before, and that such a clever mechanic as Mr. Pain was should not have hit upon it before he did, especially as his life at that time was being spent in continuously designing reciprocating machinery of different types. The invention as briefly described in the specification was as follows:

"In my improved system oil cups are dispensed

with, the oil, water, or other lubricating fluid being introduced to the various bearings under pressure from a pump, accumulator, or high-level tank by a continuous system of oilways drilled through the shaft or journal, with holes radiating therefrom to the surface to be lubricated. . . . The lubricating liquid which escapes from the bearings may be collected in a save-all, from which the pump may be arranged to take its supply. The bearings may be fitted with packing rings or other device for retarding the escape of the lubricant if considered desirable." The specification is accompanied by two quite simple drawings illustrating the principal bearings of an ordinary horizontal single-crank steam engine, which, without any text whatever, afford a perfectly clear explanation of the invention and its operation. They show, too, how ingeniously he eventually got over the difficulties in the way of applying his idea.

It is interesting to note the advantages which, according to the inventor, could be derived from his invention. There are three of them. They are, again to quote from the specification :—

"First, that the lubricant being introduced under pressure will immediately fill any spaces which may exist between the journals and their bearings, and thus conduce to the smooth working of the engine, and the said engine may be run at a higher speed than heretofore found practicable without knocking.

"Second, The bearings being very efficiently lubricated, the loss of power by friction will be less.

"Third, A cheaper form of lubricant may be used, having less body."

It was, as we have said, quite a simple invention, but it effected a revolution in high-speed steam engine construction, and it is now universally employed.

As a man, Mr. Pain is described as being always happy to do anything possible for any one in need of help. He was universally beloved by his colleagues and staff, by whom his loss will be severely felt.

HENRY McLAREN.

THE death occurred recently, while on a voyage in the Red Sea, of Mr. Henry McLaren, chairman of J. and H. McLaren, Ltd., of Leeds. Mr. McLaren, who was seventy-five years of age, was brother of the late Sir John McLaren, and succeeded him as chairman of the company.

Mr. McLaren was the third son of the late Mr. Henry McLaren, and was born at Hylton Castle, Durham. He served his apprenticeship with Messrs. Black, Hawthorne and Co., of Gateshead, and later was for a short time manager of some engineering works in Dewsbury. In 1876, when he was only twenty-two years of age, he went to Leeds, and with his brother started the firm of Messrs. J. and H. McLaren, agricultural engineers, in Jack-lane. Even in those early days his name became well known as an inventor among the makers of agricultural machinery. He invented all kinds of special ploughs, implements, and machines used in the heavy agricultural industry, and had also inventions to his credit in connection with electric generating machinery.

Mr. McLaren was known far beyond the county of York, and even in many countries abroad, as an inventor. He had travelled all over the world, and was familiar with nearly every continental country. His method was to visit a foreign country, and after making a careful inspection of the land and general conditions, and tabulating full particulars, he would return home and himself design a machine suitable to that particular country. That, in fact, was a lifelong practice with him. "He was a born engineer," says a Leeds authority. "His knowledge of the practical side of engineering was as thorough as that of the most skilled artisan, and his ability to get to the bottom of any mechanical trouble or to execute any class of work won for him the profound respect and admiration of the workmen, not only in his own works, but wherever he went."

For many years, Mr. McLaren was a member of the Institution of Mechanical Engineers, and contributed several papers to that body. He also read papers at the Leeds University and before other technical organisations. He became associated with the old Yorkshire College in Leeds as far back as 1890, and maintained his interest throughout in the Leeds University, on the House and the Engineering Committees of which he had served. It was for his valuable services in that direction that the University Authorities conferred upon him the honorary degree of Doctor of Laws.

Literature.

Electrical Transmission and Distribution. Vols. 1 and 2. Edited by R. O. KAPP, B.Sc. London : Sir Isaac Pitman and Sons, Ltd. Price 6s. each.

THESE two volumes are the first of a complete work on electrical transmission and distribution. In these and subsequent volumes the entire field will be covered by experts specialising in different branches of the work. The first volume deals with the construction and erection of overhead lines, and the authors are Messrs. J. L. Eve, H. S. Selves and Mr. Borlase Matthews. In this and other volumes of the series theoretical considerations have been kept subservient to actual practice, because the engineer is necessarily interested in successful practice rather than abstruse theory ; but whilst the work is intended chiefly for operating engineers, it is believed that it will prove valuable to consultants, manufacturers and students. The book explains the fundamental principles of overhead line construction and gives the data essential for the proper construction of the varied types of lines that the engineer may be called upon to erect. Mr. Eve deals with the construction and erection of overhead lines, Mr. Selves with the maintenance of lines, and Mr. Borlase Matthews with distribution to rural areas. An interesting section of Mr. Matthews' contribution deals with methods of reducing the costs of lines, wherein it is shown that a great deal of saving can be effected if care be taken when designing a line to see that most of the constructional work on the poles is done in the factory and not on the roadside. Various cheap forms of construction are described, including that recommended by Mr. Clough, who advocates transposing the phases as a means of short-circuiting the system in the event of a line breaking. The section of the book on the construction of overhead transmission lines covers, among other things, general considerations concerning the construction of transmission lines, type of construction, conductors, insulator materials, tension insulators, terminal and tensioning clamps, conductor spacing, earthing, the sag of conductors, supports at different levels, guarding, lightning arresters, switches, the strength of poles, foundations, steel masts and towers, struts, Bates poles, and concrete poles. Section II., on the erection of overhead transmission lines, also written by Mr. Eve, covers organisation, excavation, pole erection, the erection of steel towers, assembly and erection of insulators, stringing of conductors, sagging and binding, and section lengths.

The second volume is devoted to the subject of power cables, and it is written by Messrs. A. P. Pyne, Norman A. Allen, and "Mains Engineer." Mr. A. P. Pyne writes on the manufacture of cables, Mr. Norman A. Allen on cable laying methods and underground cables, and "A Mains Engineer" on consumers' connections. The first section, dealing with cable manufacture, is of interest to all electrical workers, who, although concerned with cables, may not actually understand the many processes involved in their manufacture. The author of this section explains exactly how conductors are made up to form a cable, how the insulation is applied, how the lead covering and armouring are perfected, and finally gives some useful hints on the handling of the finished form of cable. In the second section, dealing with the methods of laying cables, the author discusses the reasons governing the choice of system, methods of protection from mechanical damage and corrosion, the laying of cables in difficult ground, trenching, tunnelling, laying by machinery, and laying from a barge. The author also gives a large amount of information on the life of cables, depreciation costs, scrap value, and other economic facts. The third section covers the subject both from the point of view of testing and maintenance. Methods are described of carrying out the various factory and routine tests for conductor resistance, insulation resistance, capacity measurement, pressure test, bending test, earth leakage and electrolysis test. Examples are given of the chief methods in use of localising faults, and the volume concludes with a section on consumers' connections, in which attention is drawn to the various rights and obligations applying to the consumer and supply authority, the procedure before the consumer is connected to the mains, time allotted to the making of joints, the keeping of records and network readings, and some notes as to costing.

Land Drainage and Reclamation. By QUINCY CLAUDE AYRES, M. Am. Soc. C.E., and DANIELS SCOATES. London : McGraw-Hill Publishing Company, Ltd. 1928. Price 20s.

MUCH useful information relating to the reclamation of land from the sea may be derived from books and other publications, while the drainage of fens and meres, on a large scale, is mainly a matter of applied hydraulics. Neither adequate literature nor any simple application of principles of engineering is, however, available in respect of land reclamation, when the unit areas dealt with are small and are subject to seasonal swampiness, or are unfertile by reason of roughness or the prevalence of forest or jungle. Such literature as is available respecting the reclamation of small swamps, or the improvement of bad lands, is often far from convincing.

A welcome may, therefore, be accorded to a well-illustrated book of over 400 pages, in which the reclamation of land from the sea is not discussed, nor space devoted to descriptions of specific works, but in which protection from the inroads of rivers, the drainage of swamps, the clearing of bush and forest, the irrigation of arid or semi-arid lands, are all described and discussed while attention is also given to equipment, organisation, surveying and levelling operations, and legal aspects of procedure. A further very useful feature of this work is the discussion of land improvement operations, including, with much detailed instruction and many diagrams, measures to be taken to prevent or check the washing away of soils from farm lands.

Mr. Ayres is Associate Professor in charge of Drainage and Irrigation Engineering at Iowa State College ; Mr. Scoates, Professor of Agricultural Engineering at the "A. and M." College of Texas. Accordingly, the illustrative data are those of the United States, the methods such as conform to American ideas and equipment, and the legal considerations Anglo-Saxon. On the other hand, the scientific basis of the book, the methods described, in so far as they must conform to topography and soil, and the manner in which the subject is handled by the authors, render the work such as may be studied with profit in almost any part of the world.

The mission of the book is, as stated in the Preface, ". . . to fulfil the need for a treatise dealing with the drainage, reclamation, and surveying problems that arise on the average farm and that the farmer himself can well be expected to handle." The authors, justly, believe that practising engineers may find it useful for reference purposes, but ". . . . specifically disclaim any intention of presenting the subject in such a way as to produce qualified surveyors or drainage engineers from those who study it." They very properly indicate in the text what are operations demanding the co-operation of an engineer, whose services in the location and design of a drainage ditch for a large area, ". . . will usually save many times his fee."

For the purposes of the book the suppression of any serious presentment of the subject of rainfall and run-off was perhaps desirable. It is doubtful, however, whether any useful purpose has been served by furnishing a crude, rule-of-thumb method of estimating run-off. The chapters relating to surveying and levelling are adequate, covering all necessary operations, while including also simple expedients. The location, design and maintenance of open ditches are well presented, with much useful detail. Excellent advice is given in respect of the use of explosives, the removal of tree stumps, clearing land of bush and forest, and, on the administrative side, in respect of legal matters and drainage boards. The book presents within a relatively small compass such information duly related to one main subject as must elsewhere be sought in many and divers publications.

Astronomy for Surveyors. By M. K. RICE-OXLEY, A.C.G.I., Assoc. M. Inst. C.E., and W. V. SHEARER, B.Sc., Assoc. M. Inst. C.E., M.I. Mech. E. London : Methuen and Co., Ltd. 1929. Price 8s. 6d.

SOME treatises on surveying include useful chapters on astronomical observations, with a modicum of data ; but for important survey work for which such observations are necessary, it is not to be expected that a general treatise will be adequate, nor will it be found to contain the elementary instruction needed by the student, as well as by many surveyors.

Having decided to offer a small book, intended alike for students and for surveyors, Mr. Rice-Oxley and Mr. Shearer, wisely, made no attempt to deal with geodosy, confining their work to explanations of methods and computations, with some analysis of the underlying principles of astronomical work.

Mr. Rice-Oxley is Assistant Professor of Civil Engineering, and Mr. Shearer a Lecturer, both at the Imperial College, South Kensington, and their joint work has resulted in a well-balanced book, in which each part of the subject is treated with due deliberation and with a proper regard to the importance of detail. The longest chapters are those relating to Time, including the determination of local time ; Latitude and Longitude, the Determination of Azimuth, and to Instruments. Shorter chapters are devoted to Spherical Trigonometry, the separate consideration of the Determination of Longitude, to the Nautical Almanac, and Star Names and Magnitudes. The last-mentioned chapter gives very useful directions for identifying stars, and is supplemented by star charts for the northern and southern hemispheres. The precise data includes tables of mean refraction, of corrections therefor and for reduction to meridian. The chapter on instruments deserves notice, since it mainly consists of precise directions as to the care, handling, adjustments and use of the transit theodolite. In the chapter on Time, explanations of the reasons of time corrections—perhaps more properly called "adjustments" in some cases—are fully given.

This small book, of some 200 pages, may be recommended as a text-book on the subject, as extending the range of observations the nature of which most surveyors understand, and as providing them also with a basis for and instruction in observations of other kinds.

BOOKS RECEIVED.

Geology of Gold. By E. J. Dunn. London : Charles Griffin and Co., Ltd., 42, Drury-lane, W.C. 2. Price 35s. net.

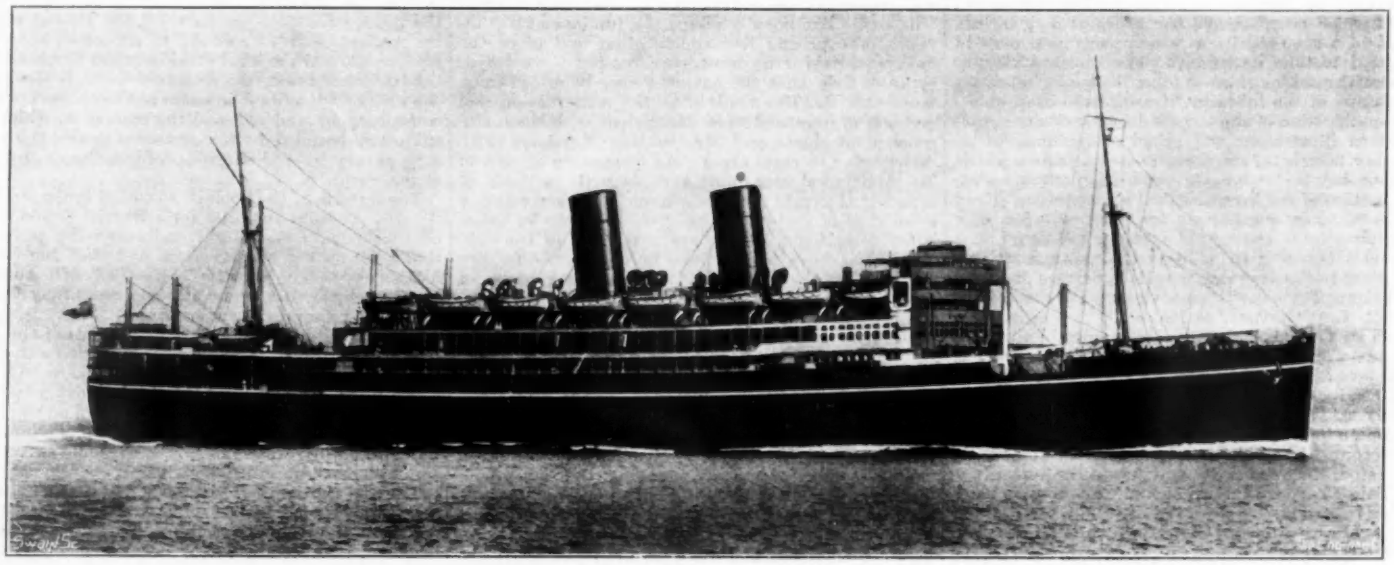
Carbonisation Technology and Engineering. By John Armstrong. London : Charles Griffin and Co., Ltd., 42, Drury-lane, W.C. 2. Price 36s. net.

Road versus Rail : The Case for Motor Transport. By C. S. Brunner. London : Ernest Benn, Ltd., 154, Fleet-street, E.C. 4. Price 2s. 6d. net.

Sell's Directory of Registered Telegraphic Addresses. London : Business Directories, Ltd., 8 and 9, Johnson's-court, Fleet-street, E.C. 4. Price 45s. net.

THE P. AND O. TURBO-ELECTRIC LINER "VICEROY OF INDIA"

ALEXANDER STEPHEN AND SONS, LTD., LINTHOUSE, GLASGOW, BUILDERS



The P. and O. Turbo-Electric Liner "Viceroy of India."

No. III. (*conclusion*).*

AFTER undergoing successful trials, the P. and O. liner "Viceroy of India," shown above, left the Clyde on Thursday afternoon last week, and arrived at Tilbury about 2.30 on Saturday afternoon. Fog was encountered both in the English Channel and the mouth of the Thames, which necessitated running the ship at reduced speeds. The new liner is scheduled to sail on her maiden voyage to Bombay on Thursday, March 28th. In the articles published in our issues of March 1st and 8th, we have dealt with the main and auxiliary propelling machinery, and have also given a brief outline of the passenger accommodation. In what follows is given, with the consent of the owners of the ship, a summary of the results obtained during the trial. Some little time must necessarily elapse before the complete trial data can be fully analysed and prepared for publication. A more extended account of the trial performances may be issued later, and it is hoped that the complete figures, together with an analysis of the vessel's performance at sea, will form the subject matter of a paper which may be read before the Institution of Naval Architects.

SUMMARY OF TRIAL RESULTS.

The trials which were carried out by the builders of the "Viceroy of India," Alexander Stephen and Sons, Ltd., under the terms of the contract with the P. and O. Company, included measured mile runs at Skelmorlie, first with one alternator driving the two propelling motors; and, secondly, with the two alternators in operation, while fuel consumption trials along with manœuvring trials were also carried out under these two sets of conditions.

The first series of trials, with only one turbo-alternator set in operation, were run on February 17th over the Skelmorlie measured mile, speeds varying from 13·13 up to 17·1 knots being obtained.

On the evening of Tuesday, February 19th, a six hours' consumption trial was made under the same propelling conditions, namely, one turbo-alternator in operation driving the propelling motors at half load. The total output was 7561 kW corresponding to 9810 S.H.P. and 91·5 mean revolutions; the mean speed of the ship was 17·1 knots, and the fuel consumption worked out at 0·715 lb. per S.H.P. hour for all purposes, the vacuum being 28·5in., and the auxiliary lighting and heating load about 700 kW. When corrected for a standard 28in. vacuum the consumption figure was 0·74 lb., to which reference has already been made in our first two articles.

The full power measured mile trials were made on Monday, March 4th, when, with both turbo-alternators in operation, a ship's speed of 19·62 knots was obtained, the mean propeller speed being 113 r.p.m. In trials carried out later, a maximum speed of 19·8 knots was attained.

The fuel consumption trials under full load conditions were run on Tuesday, March 5th, at a scheduled speed of 18½ knots, the machinery developing 13,322 S.H.P. at 103·54 mean revolutions. With a vacuum of 28·93in., the fuel consumption for the turbines only worked out at 0·581 lb. per S.H.P. hour, which is less than 0·6 lb. when corrected for standard vacuum and feed conditions. During the whole of the trials the Yarrow water-tube boilers steamed exceedingly well, and pressures and temperatures in excess of those specified were easily maintained.

After each series of trials, exhaustive reversing, manœuvring and turning trials were carried out during which the machinery behaved excellently. When running at 19 knots the liner was pulled up to a standstill in the short space of 2 minutes 10 seconds. In carrying through this manœuvre no attempt was made to hurry the engineers in making the sequence of reversing operations, and actually the time taken could have been shortened. When the ship was sharply turned, no difficulty was experienced with the two synchronous propelling motors pulling out of phase. When sufficient excitation is used there is practically no possibility of the motors getting out of step during turning movements. Should such an event happen, however, we are given to understand that the very short intervals necessary to bring the motors to rest and to run them up to synchronism again, would be so short that no loss of way would be experienced.

A feature both of the trials and the voyage round was the remarkable steadiness of the ship and the complete absence of vibration in the cabins and public rooms. The main turbo-alternator sets ran very quietly, we are informed, and only a very slight tremor could be detected when running through two critical speeds. At these critical points, moreover, the raising or lowering of the speed by one revolution was sufficient to damp out any vibration. The captain of the ship bore testimony to the excellent manœuvring powers given by turbo-electric propulsion, and the quick response to engine-room orders.

The results we have briefly outlined are particularly interesting and valuable on account of the accuracy which it is possible to use when measuring the actual power delivered at the propeller shafts. For this special purpose very sensitive kilowatt meters were used, both at the main control board and at an auxiliary test board which was temporarily set up in one of the public rooms. On the test board there were mounted, specially calibrated instruments along with a clock and a large seconds chronometer, and during all manœuvring trials a continuous cinematograph film of the board was taken. On developing

* No. II. appeared March 8th.

FIG. 15—FIRST-CLASS SMOKING ROOM

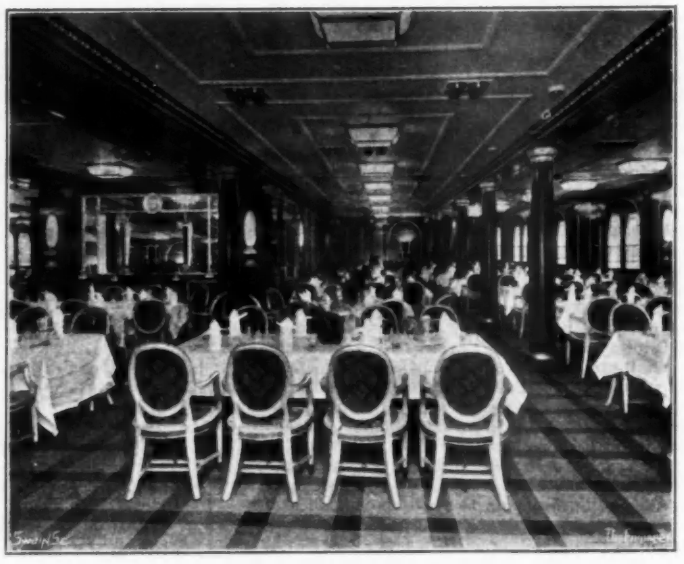


FIG. 16—FIRST-CLASS DINING SALOON

the films, it was possible to analyse all the recorded variations in current and voltage. As a check on the model experiments which were made at the William Froude National Experimental Tank, Mr. G. S. Baker and his staff took continuous records of propeller thrust and revolutions for the different trials. The complete results will be awaited with considerable interest.

TYPICAL PUBLIC ROOMS.

By the courtesy of the owners we are now able to reproduce two views of the first-class public rooms of the new liner. Engraving Fig. 15 is a view in the smoking-room looking forward. This room, which is entered from the promenade deck, and by the main staircase, has a timbered roof with a height rising from 11ft. to 17ft. It is panelled in oak and the doors and windows and fireplace are all typical of sixteenth century design. The design of the whole room was based upon examples of work which are now in the South Kensington Museum, and were taken from the old Palace of Bromley-by-Bow. The other engraving—Fig. 16—shows the first-class dining saloon looking forward. It has a length of 86ft., and is the full width of the ship. The small tables and chairs are sufficient to allow the whole of the passengers to dine at one sitting. The saloon is entered from the main staircase through a glass-enclosed vestibule which is also served by two lifts. A modern note in French decorative style has been struck, and, as shown, the walls are panelled in polished walnut, a pleasing contrast being provided by the blue pillars and pilasters. The windows are of the sliding casement type, and a very effective system of indirect lighting is installed. Attention may be called to the groups of Punkah-louvre ventilating fittings arranged in the ceilings of both rooms. The furnishing of the public rooms was carried out by Messrs. Waring and Gillow, of London, who worked in close co-operation with the owners and builders. It is of interest to record that the daughter of the chairman, Viscount Inchcape—the late Hon. Elsie Mackay—who did so much to help his lordship in furthering the needs of the travelling public, took a special interest in this ship. Her work has been very ably completed by the Hon. Mrs. Alexander Shaw, who has taken a personal interest in the scheme of decoration, and in all matters pertaining to the comfort of the passengers and crew. There is no doubt that the "Viceroy of India" will prove a very popular ship, both in the company's Bombay and world cruising services. With regard to the design of the hull and propelling machinery, much work was done in collaboration with the builders and sub-contractors by Mr. R. T. Clarke, the company's superintendent engineer, and Mr. R. W. Rugg, the naval architect. To Mr. Clarke, in particular, credit is due for his wide outlook and courage in recommending to his directors the turbo-electric drive as being more efficient and suitable for the variable speeds of the P. & O. service than the oil engine drive. The results obtained have fully justified the decision taken, and the new ship marks an important forward step in British marine engineering progress. On the builders' side, Mr. Alexander S. McLellan, the engineering director of Alexander Stephen and Sons, Ltd., has rendered especial service in co-ordinating the work of the various engineering firms, which have contributed so many new features of design. Among them we may specially mention the work done by Mr. Harold E. Yarrow and his technical staff in the design and construction of the high-pressure water-tube boilers. With regard to the main propelling machinery, Mr. W. J. Belsey and the technical staff of the British Thomson-Houston Company, Ltd., designed and supervised the installation of the whole of the electric propelling equipment, while mention should also be made of the advance made by G. and J. Weir, Ltd., in the condensing plant and closed feed system, and the great improvement in auxiliary and deck machinery of the constant-current type, contributed by Mr. Gilbert Austin.

Our thanks are due to the above-mentioned engineers and their firms for the very helpful way in which they have assisted us in the preparation of these three articles.

Notes on the Navy Estimates.

THE usual explanatory statement made to Parliament by the First Lord of the Admiralty regarding the Naval Estimates for 1929 has been issued as a White Paper (Cmd. 3283), and, in what follows, we give a summary of the principal subjects discussed.

The total net value of the Estimates for 1929 is £55,865,000, as compared with £57,300,000 for the year 1928, a reduction of £1,435,000, or very nearly 2½ per cent. This reduction, which is described by the First Lord as "considerable," is not, it is explained, accompanied by any reduction in the strength of either the Fleet or the Fleet Air Arm; indeed, it is proposed to provide two additional flights for the latter, since "modern developments have shown the necessity for" them.

The amount proposed to be voted on account of new construction during the year shows the important reduction of nearly 10½ per cent. as compared with 1928, the total being £8,621,626, or £1,008,231 less than in the previous year. The main reason for this smaller provision is, Mr. Bridgeman points out, the cancellation of the three cruisers from the programmes of 1927 and 1928, as the result of which only seven cruisers being built will be at the stage requiring large payments in 1929, as against ten in the previous year and twelve in 1927. Other contributory causes are the adoption of new designs which have reduced the cost of the flotilla leader and the submarine depôt ship included in the 1928 programme, and the fact that the progress during the year on new construction as a whole has been estimated on a very conservative basis—a policy which has been found to be conducive to economy in previous years.

The provision under Vote 4 for the Fleet Air Arm is increased by £220,000, principally in order to meet the cost of a further instalment of aircraft (two flights) for the "Glorious." This vessel will complete her reconstruction as an aircraft carrier and be commissioned during 1929, but under the modest programme which is being followed she will not have her full equipment of aircraft until 1930.

Additional provision for work at the Singapore Naval Base is responsible for a small increase in Vote 10. This work has, in the past, made only a small demand on Navy Votes in consequence of the generous contributions of New Zealand, the Federated Malay States and Hong Kong. But in 1929 the expenditure will exceed the naval share of the contributions still in course of payment by over £200,000. Now that the preliminary work of clearing the site has been completed and that the main engineering contract has been placed, the cost to Navy Votes must largely increase during the next few years, unless, of course, additional contributions from the Empire should be forthcoming.

The advancement of the new construction programme and of the Singapore Naval Base, and the gradual expansion of the Fleet Air Arm have been, since 1925, the main developments which have been kept in view. In the meantime the policy of the Admiralty has been to effect economies wherever possible in the maintenance charges of the Navy in order to offset the expenditure on these three main objects. "In doing so," remarks Mr. Bridgeman, "we have, as I pointed out in my statement last year, been greatly assisted by the absence of any disturbing feature in the general naval position, and have therefore felt justified in deferring or spreading over a long period the fulfilment of many important naval requirements. The Navy Estimates for 1929 have been framed in strict conformity with this policy. Indeed, reference to the Abstract of the Estimates will show that, apart from the two Votes I have mentioned and Vote 6—where the increase of £37,900 is due to the Admiralty taking over the entire charge of the production of charts, and is counterbalanced by an equivalent saving on Civil Service Votes—there is a reduction proposed under every Vote for the effective services. . . . I should add that in preparing these Estimates we have, as in previous years, followed the plan adopted by the late Government in preparing Navy Estimates for 1924; that is to say, after allowing for all known variations in expenditure a considerable allowance has been made for possible underspendings through unforeseen causes interfering with the progress of contract work. The allowance made on this account in 1929 is the same as has to a large extent justified itself in 1927 and 1928, but it is necessary to repeat the reservation which I made in both these years as to the possibility of a Supplementary Estimate if no interference with the progress of work should in fact occur."

To the main statement are added some "Notes on Matters of General Interest," the first subject dealt with being the

DISTRIBUTION OF THE FLEET.

It is shown that, as regards battleships and battle-cruisers, the Mediterranean Fleet during 1929 will be composed of four ships of the "Queen Elizabeth" class—the fifth ship of that class being at home undergoing large repairs—and five ships of the "Royal Sovereign" class. The Atlantic Fleet will comprise two ships of the "Nelson" class, two ships of the "Iron Duke" class, and three battle-cruisers, the "Renown," "Repulse," and "Tiger."

Aircraft Carriers.—The "Courageous" has joined the Mediterranean Fleet. The "Glorious," when her conversion into an aircraft carrier is complete, will replace the "Argus" in the Atlantic Fleet.

Cruisers.—The five 10,000-ton cruisers of the "Kent" class are now on the China Station. The four 10,000-ton cruisers of the "London" class will be completed shortly, and, as announced in last year's statement, will join the Mediterranean Fleet, replacing the existing ships of the First Cruiser Squadron. Three cruisers were removed from the Effective List during the past year, namely, the "Yarmouth" and "Conquest" and H.M.A.S. "Melbourne."

Destroyers.—The "Amazon" and "Ambuscade" have now joined the Third Destroyer Flotilla in the Mediterranean. The first complete flotilla of post-war design, consisting of the leader "Codrington" and eight "Acasta" class destroyers, relieves one of those now serving with the Mediterranean Fleet. One flotilla leader and eight destroyers of the "R" and "S" class were placed on the disposal list during the past year.

Submarines.—The six "Odin" class submarines now nearing completion will proceed to the China Station in company with the "Medway," the new submarine depôt ship, during the year. In anticipation of this, six "L" class submarines and the submarine depôt ship "Ambrose" were withdrawn from that station last summer. The six "Parthian" class submarines will, when completed, also join the China Squadron, replacing the remaining six "L" class submarines there. The submarine depôt ship "Titania" will be withdrawn from the station with the remaining "L" class submarines. Three submarines were placed on the disposal list during the last year.

River Gunboats.—The four river gunboats of the 1925 programme have now passed into service on the China Station. Three old gunboats have been placed on the disposal list in consequence, and one more will follow them shortly.

Fleet Repair Ship.—The new fleet repair ship "Resource" will replace the "Assistance" in the Mediterranean Fleet.

Sloops.—The new sloops "Bridgewater" and "Sandwich" will relieve two older sloops on the China Station.

Dominion Navies.—No exchange of Royal Australian and Royal Navy cruisers took place during the last year. H.M.A.S. "Melbourne" arrived in the United Kingdom and her crew commissioned H.M.A.S. "Australia," after which the former ship was prepared for sale in this country. Both the new 10,000-ton cruisers "Australia" and "Canberra" have been completed and have arrived in Australia. On her way out opportunity was taken by the "Australia" to visit ports in Canada and the United States of America. The two new Australian submarines "Oxley" and "Otway" have also arrived in Australia. The two Royal Navy destroyers lent to the Canadian Government and re-named "Vancouver" and "Champlain" will be replaced by two new vessels to be built in this country to the order of the Canadian Government.

Following the foregoing, there are references to Fleet activities abroad and attention is drawn to the passage of H.M.S. "Enterprise" at high speed from Dar es Salaam to Brindisi with H.R.H. the Prince of Wales on board; to the visit of H.M.S. "Cornwall" to Honolulu to take part with warships of other nations in the Captain Cook Bi-centenary Celebrations; and to the visit of the China Squadron to Yokohama in connection with the coronation of H.I.M. the Emperor of Japan.

NAVAL AIR WORK.

Steady progress continues to be made in the employment of aircraft with the Fleet, and the number of hours flown from the carriers increased in 1928 by 73 per cent. over the preceding year. Seventy-four naval officers were trained and are being employed as observers, while eight more are under training. One hundred and twenty-one Naval Officers were trained as pilots and twelve more are under training.

Wireless Telegraphy and Signal Development.—Progress in utilising the latest improvements in radio telegraphic technique continues to be made, both in connection with work in the Fleet itself and communications with shore stations and the Admiralty. Close collaboration continues with the Army and Air Force on technical matters connected with wireless telegraphy, and is of the greatest benefit to all three Services.

Broadcast to British Merchant Vessels.—For some time the Admiralty, in conjunction with the Board of Trade, has maintained a system whereby warnings can be issued without delay to merchant vessels round the United Kingdom of any events of which they require immediate notice, such as changes in lights and buoys or any dangers to navigation. A need has been felt for extending this system, so that, in any emergencies of special importance, it may be possible to issue warnings to merchant vessels in any part of the world. An organisation has now been set up to this end, making use of wireless stations on British territory in all parts of the world.

SINGAPORE BASE.

On the completion by the Admiralty of the preliminary work necessary to enable the main engineering works required for the Singapore Naval Base to be proceeded with, a contract for these works was entered into in September last. A berth for the floating dock was also prepared, and all necessary arrangements for its reception and working were carried out. The floating dock, built by Swan, Hunter and Wigham Richardson, Ltd., was then successfully towed in sections from this country and has since then been connected together. It is expected to be ready for use before the end of the financial year. The dock is the largest structure that has ever been taken through the Suez Canal, and its successful passage at that stage was a difficult and delicate operation in which the assistance of the Canal authorities was invaluable.

PERSONNEL.

As the result of a careful scrutiny of all means of effecting economy in naval *personnel*, it has been found possible to reduce the numbers borne during the current year by over 1000 below the final figure for 1928 mentioned in last year's Statement. The figure for Vote A for 1929 is the number expected to be borne on April 1st, 1929, viz., 99,800, but it is expected

to fall by another 1000 in 1929, making a reduction of 3000 in all from the numbers borne on April 1st, 1928. Amongst other economies it has been found possible to concentrate the training of boys—seamen class—at Shotley and Forton. H.M.S. "Impregnable" accordingly ended her history as a training establishment on January 1st, 1929. It has long been the aim of the Board of Admiralty to discontinue the use of hulks for the accommodation of boys under training, both on economical and on hygienic grounds.

Materiel.

New Construction: Cruisers.—The five ships of the "Kent" class, three of which were built in H.M. Dockyards, successfully completed their trials and are now on service. The "Cornwall," the long voyage of which *viâ* South American ports to Honolulu has already been mentioned, acquitted herself well on her way to China, though very rough weather was at times encountered, and all these ships have proved themselves to be very good and economical steamers. Of the four ships of the "London" class (1925 programme), the "London" is completed and the "Devonshire" and "Sussex" are approaching completion. The "Shropshire" was launched on July 5th last and is expected to complete in September next. The two cruisers of the "Dorsetshire" class (1926 programme) are progressing satisfactorily. The "Norfolk" was launched in December last and is expected to be completed in May, 1930. The "Dorsetshire" was launched on January 29th and is expected to be completed in the summer of 1930. Of the "B" class (1926 and 1927 programmes), the "York" was launched on July 17th last and is expected to be delivered in March, 1930. The "Exeter" was laid down at Devonport in August last and will be launched in the summer.

The two cruisers of the 1928 programme, which will be of the 10,000-ton type, are being ordered from Portsmouth and Devonport Dockyards respectively. They have not yet been laid down, as provision was taken in the Estimates for ordering the ships in March of this year.

Destroyers.—The extended cruise of the destroyers "Amazon" and "Ambuscade" in South American waters afforded the opportunity of testing their equipment and a large number of new features embodied in their machinery installations. During this period of three months they steamed a distance of 10,000 miles without developing any defects other than such as are normally put right by the ships' staff.

The destroyers of the "Acasta" class are proceeding satisfactorily, and it is anticipated that seven of them will be launched and completed during the financial year 1929.

The remaining vessel of the class, the "Acheron," which is being built at the Southampton yard of Messrs. Thornycroft, to the order of Messrs. Parsons, is being fitted with high-pressure steam machinery and is not expected to be completed until the summer of 1930. Orders for the leader and destroyers of the 1928 Programme have now been placed with contractors.

Submarines, &c.—The "Osiris" is now completed and the remaining vessels of the "Odin" class (1926 programme) will complete at intervals through the summer of 1929. The six submarines of the "P" class (1927 programme) are all progressing well. It is anticipated that all will be launched during this calendar year and that they will complete during the financial year 1929. Of the submarines of the 1928 programme, orders for five to be built by contract are now being placed, while one vessel will be built at Chatham yard.

The Submarine Depôt Ship "Medway" will proceed on trials about April, 1929, and complete shortly afterwards. This ship has heavy oil engines of a commercial type. The submarine depôt ship of the 1928 programme was originally intended to be built by contract, but it has since been decided to build her at Chatham.

The Fleet Repair Ship "Resource" was launched and will probably be completed in the autumn of 1929. The first two sloops of new design, H.M. ships "Bridgewater" and "Sandwich," are nearing completion. The "Bridgewater" has carried out very satisfactory trials. The four sloops of the 1928 programme will shortly be begun. Their construction was originally allocated to contract, but it has since been decided to build two of them at H.M. Dockyard, Devonport. The river gunboat will be built by contract.

New Programme.

The new programme for 1929 includes provision for commencing the construction of the following new ships:—Three cruisers, one flotilla leader, eight destroyers, six submarines, one net-layer and target-towing vessel, six sloops.

Two cruisers, two submarines, the net-layer and two sloops will be built in H.M. Dockyards. The sloops are additional to the programme as set forth in Command Paper 2476, dated July 27th, 1925. On the other hand, the aircraft carrier included in it as to be commenced in 1929 will not be proceeded with this year, as it is desired to obtain more experience with the "Courageous" and "Glorious" before laying down another large aircraft carrier.

Reconstruction and Repairs.

The "Revenge" completed a large refit in January and has rejoined the Mediterranean Fleet. The "Iron Duke" will complete a large refit in May. The "Hood" and the "Benbow" will commence a large refit during 1929. The bulging and reconstruction of the "Malaya" are now complete and she will rejoin the Mediterranean Fleet shortly. The "Valiant" will be taken in hand for bulging in March. The reconstruction of the "Courageous" as an aircraft carrier was completed in May, 1928. The reconstruction of her sister ship the "Glorious" is expected to be completed in the latter part of 1929. The regrettable stranding of H.M.S. "Dauntless," off Halifax, was fortunately followed by a fine piece of salvage work. The Canadian Government gave great assistance through the facilities afforded by the Naval Yard at Halifax. The final repairs to the ship are being executed in England, preparatory to her rejoining the Fleet.

Miscellaneous.

Catapults of different types for the launching of aircraft are now on trial and in process of development.

The progress of research has been satisfactory. While the chief object is improvement in offensive and defensive material, much of the work done is directed towards the reduction of expenditure by increasing the useful life of material.

The reduction of weight and the improvement of economy and reliability of engines continue to advance with each new design.

Attempts are being made to arrest the corrosion of steel condenser doors by coating them with rubber by a new process developed in this country.

A method of X-ray examination, developed by the Research Department of the Royal Arsenal at Woolwich, has been utilised with great advantage in the investigation of defects due to internal flaws in castings.

The development of heavy oil engines for naval purposes has proceeded steadily at the Admiralty Engineering Laboratory. The limitations of existing designs have been further investigated and new proposals arising therefrom are under consideration.

We are keeping in touch with the progress being made in the use of pulverised fuel, and with the performances of working installations both ashore and afloat.

The various processes for the low-temperature distillation of coal for the production of fuel, lubricating and other oils are also being closely followed.

The development of means for preventing the pollution of harbours by the use of oil separators continues to be energetically pursued. Plants are now installed in barges at Portsmouth and Devonport, and the future action to be taken in this matter depends upon the results achieved with these installations.

Experiments are also in progress with a view to rendering serviceable the residual oils remaining in fuel tanks, &c. An Admiralty design of separator appears to be satisfactory and should achieve important economies if successful.

Institution of Mechanical Engineers.

The Summer Meeting of the Institution of Mechanical Engineers will, by invitation of the North-Western Branch, be held in Manchester, and will begin on Monday, 24th June. The following provisional outline programme has been arranged:—

Tuesday, June 25th.—Morning: The Right Hon. the Lord Mayor of Manchester and members of the local Reception Committee will receive and welcome the President (Mr. Daniel Adamson), the Council and members of the Institution with their ladies, in the College of Technology. Reading and discussion of paper. Luncheon in the Midland Hotel. Afternoon: Alternative visits to Messrs. Joseph Adamson and Co., and Messrs. Ashton Brothers and Co., Hyde; the Chloride Electrical Storage Company and Messrs. Pilkington's Tile and Pottery Company, Clifton Junction; Messrs. Charles Macintosh and Co., Manchester; Messrs. Beyer, Peacock and Co., Gorton; and Messrs. Partington Steel and Iron Company, Manchester. Evening: Reception in the Town Hall, by invitation of the Right Hon. the Lord Mayor and the Lady Mayoress.

Wednesday, June 26th.—Alternative whole-day visits:—(1) Messrs. Leyland Motors, Leyland, or (2) Trafford Park. Morning—alternative visits to Messrs. Taylor Brothers and Co., Manchester Corporation's Barton electricity power station, Messrs. W. T. Glover and Co., Manchester Ship Canal, the Carborundum Company, the Superheater Company, Manchester Corporation's Partington gasworks, Trafford Park Estates, and Ford Motor Company. Luncheon by invitation of Messrs. Metropolitan-Vickers Electrical Company. Afternoon—Visit to Messrs. Metropolitan-Vickers Electrical Company and Combermere Abbey, by invitation of Sir Kenneth I. Crossley, Bart., J.P. Evening: Institution dinner in the Midland Hotel.

Thursday, June 27th.—Whole-day visit to London, Midland and Scottish Railway Company's locomotive works, Crewe, or morning: Alternative visits to the National Gas Engine Company, Ashton-under-Lyne; Messrs. Mirrlees, Bickerton and Day, Stockport; and the Vulcan Foundry, Newton-le-Willows. Afternoon: Alternative visits to Salford Corporation's Agecroft electricity power station; Oldham Corporation's Slack's Valley electricity power station, Chatterton; Messrs. Mather and Platt, Newton Heath; Messrs. Crossley Motors, Gorton; Messrs. Crossley Brothers, Openshaw; London, Midland and Scottish Railway Company's carriage and wagon works, Newton Heath; and Thornycroft Hall, Siddington, by invitation of Mr. H. N. Bickerton, J.P. (member), and Mr. Charles Day, M.Sc. Tech. (member of Council). Evening: Reception and dance, by invitation of the local Reception Committee.

Friday, June 28th.—Whole-day visit to Buxton, Haddon Hall, Chatsworth House, or Chester and Eaton Hall; or morning and afternoon: Alternative visits to the Broughton Copper Company, Manchester; Messrs. Hans Renold, Manchester; Messrs. Churchill Machine Tool Company, Altrincham; Messrs. Henry Simon, Cheadle Heath; the Budenberg Gauge Company, Broadheath; Messrs. Linotype and Machinery, Altrincham; and Mersey Tunnel, Liverpool. Evening: Reception, by invitation of the Chancellor and Council of Victoria University, Manchester.

South African Engineering Notes.

Rhodesian Copper Mines.

It has now been realised that Northern Rhodesia contains the biggest copper field in the British Empire, even if the ore already developed in three properties alone be taken into consideration, while it is certain from the reports of the experts that many other deposits, of equal importance to those already proved, may be confidently anticipated. None have been so prompt to recognise the enormous potentialities of the northern copper field as American interests which have already acquired such large quantities of shares as to give them the control of some of the properties and large holdings in others. On the testimony of two well known consulting engineers, Mr. George Beatty and Mr. F. A. Unger, N'Kana, a subsidiary property of Bwana M'Kubwa Copper Company, has now in sight over 30,000,000 tons of copper ore averaging 4 per cent. metal, whilst the Roan Antelope Mine has over 24,000,000 tons of a value of 4·2 per cent., and M'Changa Mine over 12,000,000 tons at 3·8 per cent. copper. These experts are, moreover, confident that further great discoveries of ore are to be anticipated. The intensive geological work which was carried out recently in the Rhodesia-Congo border concessions, has revealed the fact that areas previously considered of no great importance now hold out prospects on account of their geological structure. In that part of the world, favourable geological structures are of the utmost importance. Most, if not all, of the copper occurrences in the region appear to be associated with synclinal folding, and any evidence of that kind of folding holds out great potentialities. Exploratory work of a preliminary nature will be commenced on some of these discoveries, and will be followed by drilling if results warrant it. Indeed it may, the experts state, be said with some confidence that the discoveries already made are only the beginning of the mineral history of Northern Rhodesia. Work on the mines and prospects which are now being developed is still in the initial stage, but the efforts of the various Boards concerned are all in one direction—namely, to reach the producing stage as early as possible, and to carry out operations on a scale commensurate with the size of the deposits.

Manganese Ore.

According to the latest information a group of British iron and steel masters has at length concluded an arrangement with the Union Manganese Company, whereby the large deposits of manganese ore in the Postmasburg will be developed, the ore being conveyed by rail through Kimberley to Colenso (Natal), and there electrically treated in furnaces. The ore will be converted into ferro-manganese and exported through the port of Durban. A German group of steel makers has been in negotiation with other manganese companies, having properties in the same district, for some time.

Extracting Oil from Coal.

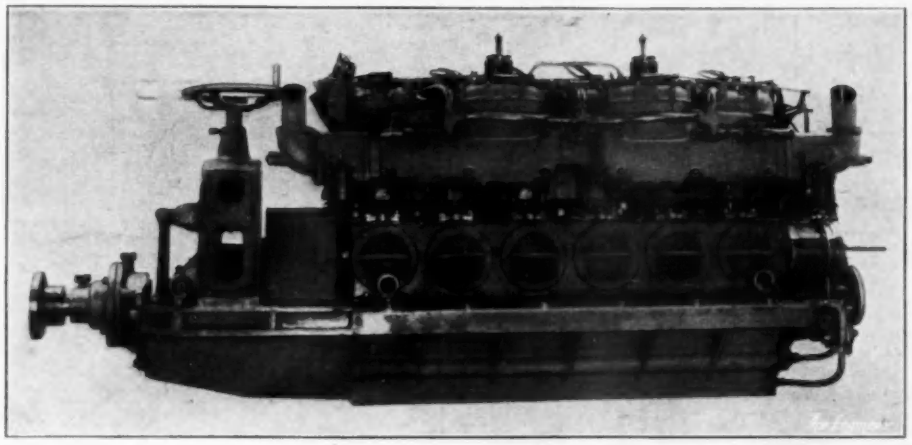
Funds to provide for extensive research work in the direction of oil from coal will shortly be forthcoming. The Government will vote £30,000 this year, and for some years to come, to cover the annual running costs of a Fuel Research Institute. This contribution will probably not be the whole extent of Government assistance, however, for a scheme is now before the Cabinet which has for its object the provision of a sum, not exceeding in the first instance £250,000, to be used in the form of subsidies to firms concerned in the extraction of oil from coal.

By these means the Government hopes to give encouragement to a South African oil industry, and to protect it from unfair competition from overseas. The coal deposits of the Union are estimated at 250,000,000,000 tons, a large proportion of which is expected to yield a high proportion of oil. In addition, there are extensive shale deposits, about the quality of which experts differ, but which may add to the Union's oil production. A further scheme which may be announced in a short while is the amalgamation of all coal tar producing companies which may be willing to co-operate with the main company, which is expected to be a subsidiary company of the Iron and Steel Company. The site of the Fuel Research Institute remains to be decided. The Transvaal, as the Province possessing the most extensive coal deposits, has many claims, but Natal may wish to have the work carried on within its borders. Further, the Transvaal has two universities, and at Witwatersrand very special facilities are available. Similarly the Transvaal University College would keenly appreciate the Institute in Pretoria.

Dr. P. N. Lategan, the Union Government's research worker in the problems of obtaining oil from coal, has recently returned from the United States, where he represented South Africa at the International Conference on Bituminous Coal. At that conference he heard Mr. Karl Krauch, director of the German Dye Trust, describe the liquefying of coal by the improved Bergius process, and is now advocating the installation of plants to operate on that system so as to render South Africa independent of foreign oil supplies. Dr. Lategan, however, proposes that the plants should be erected and operated by Germans, and that proposal does not by any means meet with universal approval.

A SIX-CYLINDER 120 B.H.P. MARINE OIL ENGINE

THE PARSONS OIL ENGINE CO., LTD., SOUTHAMPTON, ENGINEERS



A Six-cylinder 120 B.H.P. Marine Oil Engine.

In the course of a recent visit to the Town Quay Works of the Parsons Oil Engine Company, Ltd., we inspected, both under bench trial conditions and in course of manufacture, some examples of marine and industrial type paraffin engines of a new design which has been evolved from the firm's standard 6¼in. by 8in. engine described in THE ENGINEER of July 17th, 1925. In the new series a piston, 7in. diameter, with the same 8in. stroke, has been adopted, and new features have been introduced which give increased output and efficiency. If the designed outputs of the six-cylinder marine type units be compared, then at 750 r.p.m. the 85 B.H.P. output of the 6¼in. engine has been increased to 120 B.H.P. in the 7in. model.

The engines are built in units of four, six and eight cylinders, and the normal rated outputs are 70, 105, and 140 B.H.P. respectively, at speeds of 750 to 800 r.p.m. The particular engine we have chosen for illustration is a standard marine unit with a direct-coupled clutch and reverse gear. This gear is shown in the engraving above. It is robustly built, and embodies a totally enclosed ball thrust bearing. The design provides for full engine speed, both ahead and astern, and the gear has been constructed in such a way that it can be run, we are informed, for long periods at full astern power without overheating. In the industrial type of engine the clutch and reverse gear are omitted, and a coupling or other means of drive is provided outside the fly-wheel.

The bed-plate crank case, and crank shaft are generally similar to those adopted in the smaller engines. At the side of the bed-plate is formed a water jacket, which supplies each cylinder block with cooling water. A cooling water jacket in the bed-plate also serves to reduce the temperature in the oil system. The main duct carrying the lubricating oil passes outside the bedplate and runs the whole length of the crank case. Drilled holes lead from it to the main bearings, from which the lubricating oil passes through holes in the crank shaft webs to the bottom ends of the connecting-rods. The oil which is thrown off from this system lubricates the other working parts of the engine. The circulating water and oil pumps are of the gear type, and on the engine we inspected a neat form of bilge pump was also fitted, complete with a hand disengaging gear.

The principal alteration is that which has been made to the cylinder jackets and heads. They are now cast in pairs in place of the earlier single-cylinder construction. The shape of the combustion chamber is clearly indicated in the drawing, Fig. 1, while Fig. 4 illustrates a cylinder jacket casting along with the cylinder head. Attention may be called to the well-rounded valve pockets, upon the design of which much care has, we learn, been expended, with a view to giving the engine a wide range of speed. The deep gutters or channels which separate the gas and flame joints and the water joints, and which run along the valve side of the cylinder head and around the back water port, should also be noticed. These channels provide a ready means of detecting any possible leaks in the joints when made. The cylinder covers are held in position by a series of studs with neat cap nuts, and the removal of a cover gives full access to both pistons and valves. Considerable modifications have been made to the vaporising system, and the new design of vaporiser incorporates several modified details. The main object aimed at was to obtain a correct balance in the amount of heat actually required for vaporisation, so that, when the engine has once been properly tuned up, no adjustments are called for.

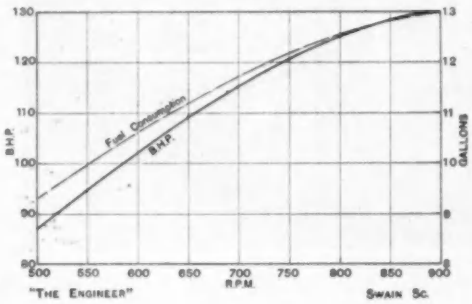


FIG. 2—POWER AND FUEL CURVES

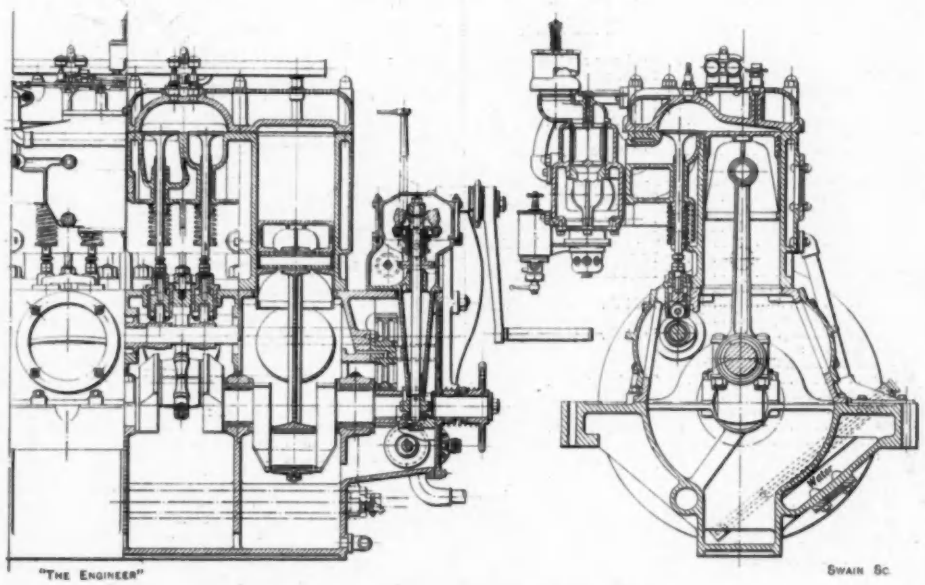


FIG. 1—LONGITUDINAL AND CROSS SECTIONS

At the right-hand end of the longitudinal section—reproduced in Fig. 1—the governor drive and the hand-starting arrangements will be seen. The speed of the engine is controlled both by hand and by the governor, the system being such that, with the exception of the shutting down operation, the hand control never puts the governor out of action. As shown in our first illustration, the engine controls for the marine unit are mounted at the after end of the engine alongside the reversing and the clutch hand wheel. This arrangement enables manœuvring orders to be carried out without loss of time.

For the industrial type of engine the controls are grouped near to the starting handle at the opposite end of the engine. As shown in Fig. 3, the ignition is by means of a high-tension magneto and distributor, with a battery system fitted as a stand-by. As, however, an impulse starter is provided on the magneto, the starting operation is a very simple one, and there would appear to be only a very remote need for the auxiliary battery system. When necessary, an electric starter can be supplied. The ignition leads are housed in thin tubes, which are clipped to the cylinder heads by single-screw clips, enabling the cables to be quickly dismantled when it is desired to examine the cylinders or pistons. The vaporiser is provided with two automatic air valves, and oil pressure gauges and revolution indicators are fitted as required. During the trials we witnessed the engine ran very quietly.

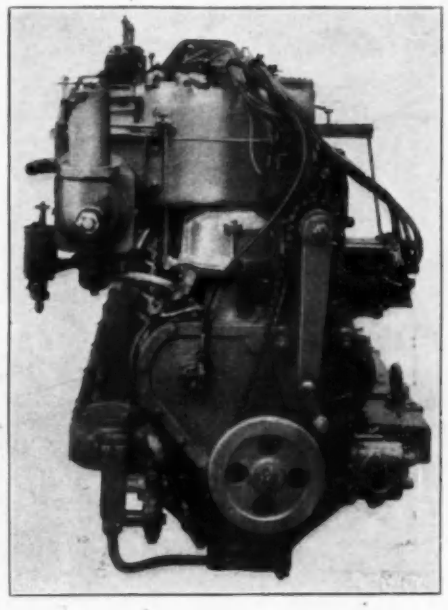


FIG. 3—END VIEW OF ENGINE

The trials of the new series of engine have, the makers inform us, proved to be extremely satisfactory, and as we have already indicated, a large increase in output has been obtained. The performance of the particular engine we have described, with respect both to its output and its fuel consumption, is shown by the accompanying curve—Fig. 2. In this curve the brake horse-power and the fuel used in gallons are plotted on a speed base. The fuels employed in the trial from which these curves were derived were 0·80 to 0·82 specific gravity paraffin oils, and the full load fuel consumption worked out at 0·85 lb. per B.H.P. hour at the lower speeds and 0·80 lb. at the higher speeds, which are those used in regular service.

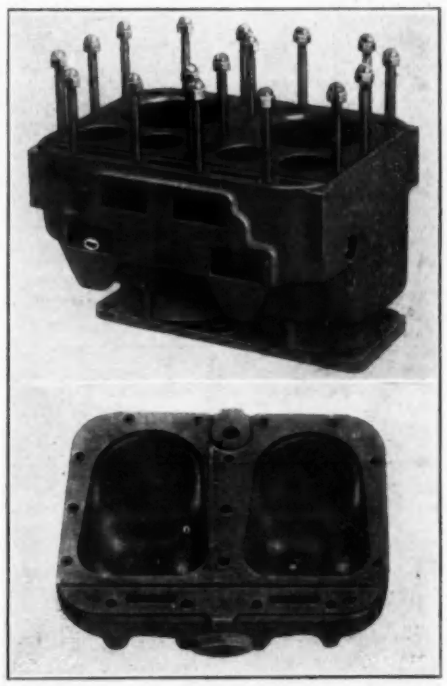


FIG. 4—CYLINDER BLOCK AND HEAD

IT is suggested that a pontoon bridge should be constructed across the Yangtze River to connect Nanking with Pukow, the terminus of the Tientsin Railway.

Powdered Fuel Tests on Lancashire Boilers.

TOWARDS the end of January we were invited to inspect the new demonstration station of B. and L. Powdered Fuel, Ltd., at Savill Bros.' Brewery, Stratford, and to witness the trials then being made on two Lancashire boilers fitted with the Brand system of pulverised fuel firing. A view of the installation is reproduced in Fig. 1, which shows the two types of pre-furnace which were used. The boiler on the right is equipped with the horizontal or long form of pre-furnace which was described in THE ENGINEER of September 21st, 1928. A view with the furnaces open is shown in Fig. 2. On the boiler to the left of our illustration there were fitted two short pre-furnaces with the burner inclined at an angle as shown in Fig. 3. Seven-day trials were run on both boilers under the supervision of the general manager of the company, Engineer-Captain J. C. Brand, R.A.N. (Ret.), and his technical staff. Little difference was found in the results obtained from the two types of pre-furnace, but those achieved with the long horizontal furnace were slightly the better of the two. The fuel used for these tests was Darton Main slack, which was delivered to a No. 8 Atritor pulveriser motor-driven. The primary and secondary air was supplied by a motor-driven fan and was heated to 110 deg. Fah. by special heaters arranged in the central flue.

Arrangements were made to use either direct firing or the Brand bin system of distribution, but in nearly all the tests the pulveriser was arranged to deliver the powdered coal directly to the centrifugal distributor to be seen in Fig. 1 mounted above the boilers. Sections through the distributor are given in Fig. 4. It is of a patented rotary type and was designed by Mr. Chas. Skentelbery and Mr. G. R. Alden, both engineers on the London staff of the United States Shipping Board. In the experiments we refer to, the powdered coal was delivered along with the primary air to the central connecting pipe which forms the top of the distributor. Immediately below the entrance there is a right-angled connection for additional primary air, which is admitted to the central stream through a series of tangential slots in a sliding sleeve valve. Provision is made for adjusting the amount of additional air thus given, which controls the degree of rarefication in the air and coal dust mixture. This fitting is only used when working with the Brand bin system, and it was not employed in the tests hereafter referred to. The powdered coal and air are delivered at the centre of a revolving fan which distributes the full charge to the four branch connections. The latter are taken off in a tangential direction and they are connected to the burners by flexible metal tubes fitted with shut-down cocks. The distributor we have described was driven by a 3 horse-power motor running at a normal speed of 700 r.p.m., which was reduced by a P.I.V. variable gear-box to 286 r.p.m. at the distributor. At this speed very equal distribution was obtained.

In addition to the seven-day demonstration trials referred to, an independent twenty-four-hour test was run on the right-hand boiler fitted with the horizontal type of pre-furnace on Friday and Saturday, February 8th and 9th, by Mr. W. H. Patchell, the results of which are given in the following table :—

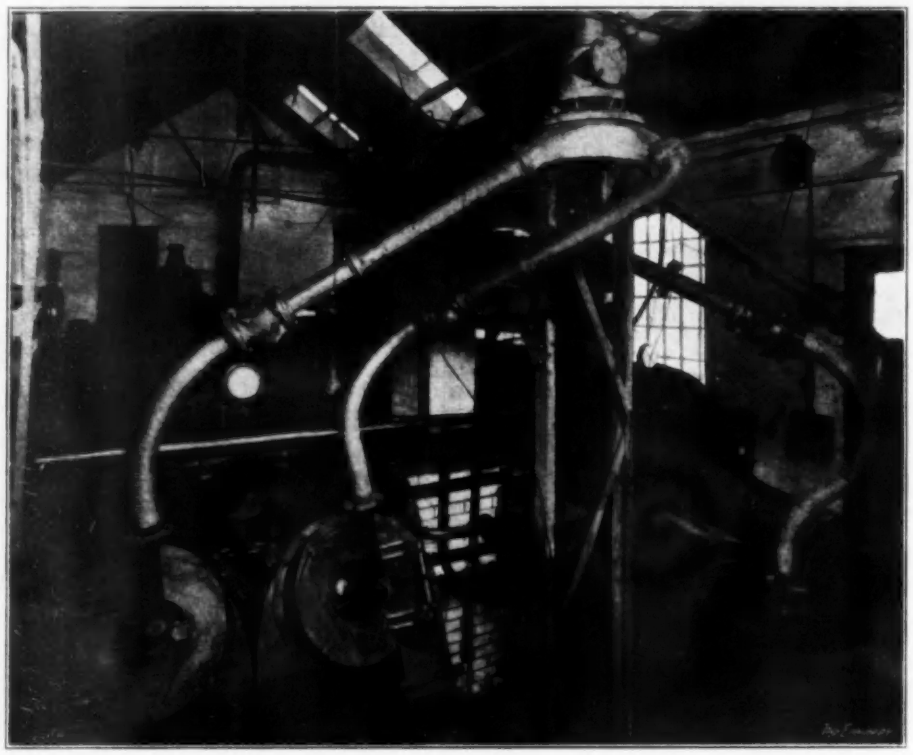


FIG. 1—LANCASHIRE BOILERS ARRANGED FOR PULVERISED FUEL FIRING ON THE BRAND SYSTEM

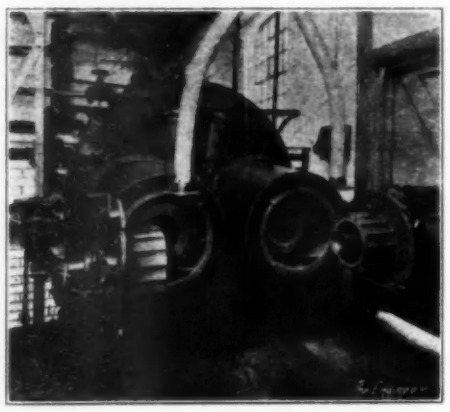


FIG. 2—BOILER WITH PRE-FURNACES OPEN

Test of Brand System on a Lancashire Boiler.

Type of boiler	Lancashire two-furnace
Size of boiler	26ft. by 7ft. diameter
Duration of test	24 hours
Heating surface of boiler	778 square feet
Furnace volume	2 by 155 cubic feet
No superheater or economiser fitted	
Air temperature	36·8 deg. Fah.
Feed water temperature	40 deg. Fah.
Coal used	Darton Main slack
Analysis as fired :	
Moisture	1·81 per cent.
Volatile matter	29·67 per cent.
Fixed carbon	54·88 per cent.
Ash	13·64 per cent.
Calorific value by bomb	12,902 B.Th.U.
Sieving test (IMM.) :	
Remaining on 100 mesh	1·5 per cent.
Passing 100 and remaining on 150	3·1 per cent.
Passing 150 and remaining on 200	3·0 per cent.
Passing 200	92·4 per cent.
Power expended in preparing, transporting and firing the fuel	15·25 kWh
Steam pressure	90·7 lb. per sq. in. abs.
Total coal used	17,230 lb.
Total water evaporated	129,950 lb.
Water evaporated per pound of fuel as fired	7·54 lb.
Water evaporated per pound of fuel from and at 212 deg. Fah.	9·04 lb.
Gross heat balance :	
Gross overall thermal efficiency of boiler	69·02 per cent.
Heat lost in chimney gases	13·3 per cent.
Radiation and other unaccounted losses	17·68 per cent.
Gas analysis at front of side flue, first pass :	
CO_2	14·13 per cent.
Co	0·18 per cent.
O	5·3 per cent.

Smoke : Only a light vapour was visible and very seldom so much as that. No dark smoke was at any time apparent.

Pressure and Temperature Readings.

	Pressure in water column.	Temperature, deg. Fah.
Air at main fan	3·22	38·6
Fuel to furnace	—	108
Secondary air to pre-furnace	2·04	108·5
Secondary air at inner sleeve	2·00	—
Secondary air at outer sleeve	0·775	—
Air and flue gases at pulveriser	0·19	151
Primary air and fuel from pulveriser	3·9	108
Gases at back of furnace flues	—	1130
Gases at base of chimney	—	592

The following remarks by Mr. Patchell on the performance of the plant may be quoted :—

"The evaporation of 5400 lb. per hour from the small boiler at 40 deg. Fah. feed struck me as exceedingly good. The mill and burners both behaved very well. There was not the slightest trouble with either. There was no sign of clogging in the pipes or sticking of the pulverised fuel in any way. Turning up boiler records for tests of 26ft. by 7ft. Lancashire boilers, with economisers, the rates of evaporation range from 3600 lb. to 3800 lb. of water per hour. This is, of course, with hot feed, but even with this the efficiency of the boilers only ranges from 55·7 to 55·6 per cent. The flame looked very well. It would have taken an expert familiar with oil burners to tell the difference between the flame and the flame of an oil burner." From the figures above given it may be anticipated that with pre-heated air 150 deg. Fah. above the atmospheric temperature the efficiency of a Lancashire type boiler fired on the Brand system with pulverised fuel would be, it is calculated, about 75 per cent.

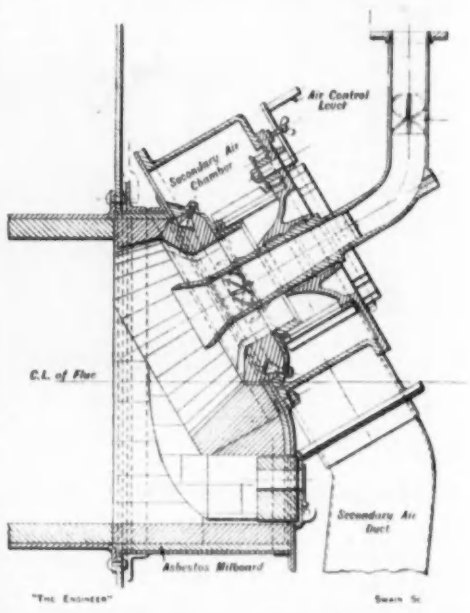


FIG. 3—FURNACE WITH INCLINED BURNER

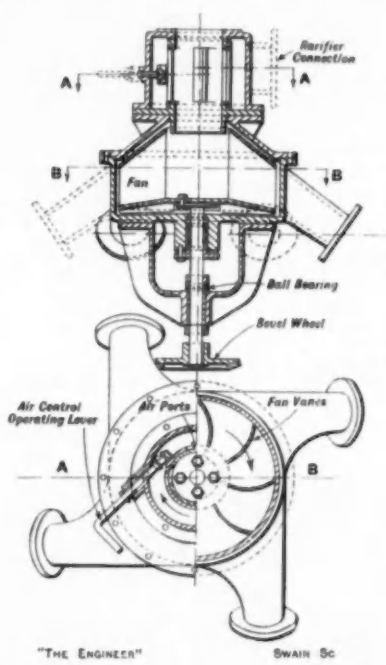


FIG. 4—ARRANGEMENT OF DISTRIBUTOR

THE INTERNATIONAL EXHIBITION, BARCELONA.—In connection with the International Exhibition at Barcelona, which opens in May, detailed arrangements are being undertaken by the township of Barcelona, which is defraying the expenses, amounting to about £5,000,000. The Exhibition has received the patronage of the King of Spain, and the Spanish Government is actively co-operating. A strong British Committee has been formed. It includes Sir Philip Cunliffe-Lister, President of the Board of Trade ; Viscount Rothermere, Lord Kylsant, Lord Waring, Lord Riddell, Lord Melchett, Sir Charles Wakefield, Sir Arthur Balfour, Sir Auckland Geddes, Sir William P. Burton, Sir John F. Beale, and Mr. John Walter. All the leading nations will be represented by exhibits. One section is to be given over entirely to the display of the products of British firms. The Spanish nation hopes that the Exhibition will be the means of extending British commercial interests in Spain. In the opinion of Spanish business men, it is not sufficiently recognised in Great Britain how big a market there is in Spain for British exports, and what efforts other countries, notably France and Germany, are making to capture the field. Spain is undertaking an ambitious programme of progressive modernisation, and, with the help of her Government, is developing her railways, irrigation, hydraulic and electrical power, ha bours and docks. In the construction of her arterial roads for motor traffic she is spending alone many millions of pounds sterling. The British Section Office of the Barcelona Exhibition is at 42, Pall Mall, London.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Iron Trade Outlook.

BUSINESS proceeds steadily in the iron and steel and heavy engineering industries of the Midlands and Staffordshire and the past week has witnessed no development of moment. Raw iron values have now been definitely stabilised at the higher rates, and the tendency for steel to become dearer increases, and although no price change has as yet been made by makers of finished material half products are being sold at enhanced rates. The prospects of better times in store for the iron and steel trades of this area, to which I have referred several times recently, and the optimism expressed by local manufacturers, is shared by Colonel Trinham, President of the Midland Iron and Steel Wages Board. At a recent meeting of that body he stated that, at last, ironmasters' hopes of better trade had grown stronger, and were built on more substantial evidence than had been the case in recent years. Costs abroad were steadily rising, bringing continental prices nearer to British prices, though a very wide gap still existed between so-called wrought iron—a mixture of iron and steel produced under unfair labour conditions from the Continent—and true wrought iron as produced in this country under recognised labour conditions, which made the true wrought iron trade easily assailable where cheapness without regard to quality was the first consideration. Referring specially to the wrought iron trade, he said it deserved to be kept alive, and there were makers who were determined that it should be kept alive, and should some day, soon they hoped, return to some measure of its former prosperity. The ironmasters had done a great deal in propaganda work, and had been successful in getting a revised British standard specification for wrought iron with the view of true wrought iron being employed where its use was demanded. They had also taken steps which they hoped would go a long way towards stopping the importation of so-called wrought iron under a misdescription, and, as far as energy and knowledge were concerned, he could think of nothing which had been over looked which would promote the welfare of the trade.

Finished Iron.

Though ironmasters' production costs have increased they have so far refrained from adding anything to the selling price of best quality bars, and there has been no alteration of the fixed rate of £12 per ton for marked bars. Some Staffordshire mills are asking an extra 5s. for the best grades of Crown iron, and values are likely to appreciate in sympathy with the recent Lancashire advance. Crown bar prices are not controlled in this district, makers acting independently. Some improvement has been apparent in this branch during the last few weeks, but more work would be welcome to keep mills running regularly. The business being done in nut and bolt and fencing quality bars, at £8 12s. 6d. upwards, is meagre, makers having little chance against Belgian No. 3 iron at £7 5s. delivered into the Black Country. Despite the slowness of demand the healthier tone of the Staffordshire wrought iron trade is maintained, and in view of the continental conditions a more hopeful view of the future is taken by prominent ironmasters.

Raw Iron.

Midland blast-furnacemen have now consolidated their position, and on 'Change in Birmingham to-day—Thursday—any wavering there was was on the part of buyers. Derbyshire No. 3 foundry iron was quoted firm at £3 2s. 6d., and Northamptonshire at £2 19s. at furnaces. The flow of business to the furnaces is not so large as it was a week or two ago. Many consumers took advantage of the opportunity to lay in stocks when prices were raised to £3 and £2 17s. 6d., and now that all the furnaces are firm at the new figure there is not much eagerness to buy. Smelters maintain that stocks of pig iron have diminished, and that consumers, who for the most part have been buying from hand-to-mouth for many months, have little to work on. Furnacemen are having to pay 14s. 6d. at the ovens for furnace coke for all contracts now being made, and they consider themselves justified in standing out for the new selling rates, which only afford them, they say, a reasonable margin of profit. The foundries are not consuming heavy quantities, and some of those who have fair stocks are of opinion that if they can delay buying long enough the price will come down to what they consider a more reasonable level. The trend of the market does not suggest this however.

Steel.

The steel market continues active and values all round are strong. The demands made upon local mills for heavy joists and sections are on a moderate scale, owing to the quiet conditions prevailing amongst structural engineers. Orders and inquiries are for small tonnages, which the steel mills are able to supply promptly. Shipbuilding material is in better demand, and Black Country industries are anticipating the receipt of orders for chains, cables, anchors and other goods which will eventually be required. Angles and joists are quoted £7 17s. 6d.; tees, £8 17s. 6d.; ship, bridge and tank plates, £8 12s. 6d.; boiler plates, £9 15s.; Staffordshire hoops are £10 at works. In semi-finished steel the firmer tendency of prices is maintained, and English makers of billets are getting a good deal of the business that formerly went abroad. From £6 7s. 6d. to £6 12s. 6d. is quoted for 2in. billets, and sheet bars command about £6 5s. to £6 7s. 6d. Regular buyers of continental billets state that it is almost impossible to get supplies and foreign prices generally are on a high level. Midland re-rollers of steel are fairly busy, and prices of small bars continue to creep up. Some sellers are now asking £8 5s., though £8 may be regarded as better representing the market level.

Galvanised Sheets.

Galvanised sheets are not in such good request as they were, and this week the sheet market was not so active as it has been of late. Makers still have good order books, but whereas they recently would have demanded £13 15s. for 24-gauge corrugated sheets, they are now prepared to accept £13 12s. 6d., or possibly 2s. 6d. less for an attractive order. Black sheets continue to sell in moderately good quantities at recent rates.

Wire.

Sales of most descriptions of wire used for manufacturing purposes have fallen off somewhat as the result of the advance last week of 20s. a ton in prices. In a few cases the increase was limited to 10s. Few wire rods are being imported, and steel rollers generally are free from foreign competition.

Scrap.

Birmingham merchants report an increase in demand from Welsh steelworks for steel scrap, and supplies have been rather scarce, with fully £3 12s. 6d. delivered South Wales being realised.

New Industries for Wolverhampton.

Two new industrial concerns, which will together employ some 600 hands, are about to be established in Wolverhampton. An international firm, manufacturing road-making materials and general chemicals, has decided to put down plant in Wolverhampton, but the actual site has not yet been settled. The firm, I learn, already has works on Thames-side and in Germany, and anticipates the employment of about 500 hands. The other firm is to manufacture agricultural machinery of a specialised kind, and general horticultural goods, including a liquid spraying machine as used by market gardeners and farmers. A site has already been secured, and the firm, which hopes to employ up to 100 hands, will commence operations in a few weeks time. The Wolverhampton Development Association states that other inquiries have been received for works sites, two of them of big dimensions, which if they mature will find employment for several thousand hands.

Edge Tools.

Black Country manufacturers of heavy edge tools are at the moment fairly engaged. The dullness which has characterised the Eastern markets for some months past shows signs of passing, business from this quarter having improved during the past few weeks. A good many factors influencing the position in the East have been apparent, and the edge-tool market seems to be very susceptible to these, which are promptly reflected in the activity of local factories. The outlook is also considered better as regards the South American trade, and firms concentrating on these markets express satisfaction with the volume of business received so far this year and with immediate prospects. A few good orders have been lately received for the Australasian markets.

Unemployment.

Unemployment in the Midlands is again on the decline, and the current total of 186,552, though only lower by twenty-four than that of a week ago, shows a decline of 12,114 on the figure ruling at the opening of the month. Of the total no less than 142,346 are men. There are 37,814 women, 3155 boys, and 3207 girls unemployed in the area. The towns showing improvement last week were Birmingham, Derby, Dudley, Leamington and Warwick, Northampton, Nottingham, Peterborough, Stoke-on-Trent, Tipton, Wolverhampton, and Worcester. At Coventry the total rose from 2394 to 2401, of whom 678 were on short time or temporarily idle.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Electric Railway Signals.

A BEGINNING was made last Sunday with the plan of the London, Midland and Scottish Railway to install electric signalling on the line between Manchester (Victoria Station) and Salford (Ordsall-lane). The first station is now in operation, another is to be started next Sunday, and the third, which will complete the present scheme, on the following Sunday. An official statement on the first day's working under the new system was that the experience had been satisfactory. Such a description, however, could hardly have been applied to the events of the following day, particularly in the morning, when the handling of rush traffic under foggy conditions led to appreciable delay. The trouble diminished as the day wore on, though even in the evening the failure of the light signals to function properly resulted in trains from Manchester to Preston, for example, a distance of about 30 miles, being overdue by from half an hour to nearly an hour. Primarily, however, the disorganisation was due to the fact that the system in question was quite a new one on this stretch of line, and the officials are confident of smooth working as more experience is gained.

The Manchester-Liverpool Road.

By the recommended acceptance by the Roads and Bridges Committee of the Lancashire County Council of the tender of Sir Lindsay Parkinson, a well-known Blackpool firm of contractors, and its probable confirmation by the County Council this week, the projected arterial road between Manchester and Liverpool will begin to take practical shape. The tender in question amounts to over £2,000,000, but by the time the road is fully completed the total cost will be in the neighbourhood of £3,000,000. The road will be 22 miles long, 120ft. wide between the fences, with a 40ft. central carriageway and a 10ft. grass verge on either side, two 20ft. side roads for slow traffic, and two 10ft. footpaths. The work to be tackled first includes the 40ft. carriageway and the footpaths. Apart from the demolition of about 130 houses, the work will entail the construction of nine railway bridges, three colliery railway bridges, twenty-two stream bridges, and one canal bridge. At the Liverpool end of the road a stretch of about 2 miles is to be constructed within the city boundary in continuation of the road to which the Parkinson tender refers.

Aviation Works for Manchester.

The announcement has been made this week that the Berkshire Aviation Company, which is associated with Lancashire and Yorkshire Airways, Ltd., a company which has secured the use of the municipal aerodrome to be constructed by the Manchester Corporation at Chat Moss, has decided to transfer all its repair plant from Monkmoor Aerodrome, Shrewsbury, to a site at Chat Moss.

More Money for Mersey Tunnel?

The question whether the £5,222,000, which was the estimated cost of the construction of the new tunnel under the river Mersey connecting Liverpool with Birkenhead, will be sufficient to complete the work, which has been in progress for some considerable time, has come under discussion. An explanation has been given by Sir Thomas White, who is the chairman of the Tunnel Committee. In view of certain suggested alterations to the tunnel entrances, the question has now arisen whether the estimated cost will be exceeded. On this point, Sir Thomas states that an inquiry is being held to see if, after the alterations have been made, the money will allow of architectural features, or whether the entrances will have to be plain. It is understood that the Birkenhead representative on the Committee will make fresh claims on the funds.

Fleetwood Dock Extensions.

The London, Midland and Scottish Railway Company has placed the first portion of the contract for the extension of Fleetwood's docks, at a cost of £100,000, with Thomas Wrigley, Ltd., a Manchester firm of railway contractors. An important feature of the extension scheme relates to the widening of the fish stages along their entire length.

Electrical Plant for Stretford.

The Central Electricity Board has approved tenders, amounting in the aggregate to £80,000, for the supply of high-tension cables, switchgear, and transformers to Stretford Council.

Gas Engineer's £2250 Salary.

Notwithstanding various proposals that the figure should be reduced to £1500 and £2000, the Manchester City Council has adopted the recommendation of the General Purposes Committee that the position of chief engineer of the Manchester Corporation gas undertaking should be advertised at a salary of £2250 a year. Opposition seemed to be based mainly on the ground that the salary of none of the principal administrative officials of the Corporation, including that of the chief electrical engineer, exceeded £2000, but the Council decided by a fairly substantial majority that in view of all that had recently occurred the appointment in question should be treated as a special case and that the salary should be such as to ensure applications from the most expert engineers available.

Engineers and Russia.

A large number of the leading engineering firms in Lancashire are closely associated with the movement for a visit of a British trade delegation to Russia, for a good many firms in this part of the country, particularly textile machinists, are closely interested in the Russian market, which, up to the time of the breaking off of diplomatic relations between Great Britain and Russia, was providing substantial orders for engineering products of various kinds. The delegates will leave London for Moscow on March 25th.

Non-ferrous Metals.

Conditions in the non-ferrous metals market this week, more particularly in the copper section, have been rather less spectacular than in the previous week, and except in spelter, there has been a loss of ground in every section. To some extent, of course, that was to be expected, for it is known that speculative interests have been actively associated with more than one metal, and what more natural than that, after the advances in copper and lead reported a week ago, there should be a certain amount of profit-taking? This factor has been responsible largely for the reaction in copper, values in this section having lost a good portion of the rise previously recorded. Although at the moment of writing the tendency appears to be easy, with buying interest less active than of late, the undertone is anything but weak. Similar conditions have operated in the case of lead, the price of which is now back to where it was a fortnight ago. The demand for the metal, however, is still fairly good. With regard to tin, inquiry from industrial consumers, has on occasions, been reasonably brisk. The price position, however, is still a matter of considerable uncertainty, and for the fifth week in succession values have lost some ground. Spelter has met with a fair amount of support from buyers, and although there have been fluctuations in the course of the week, there has been little actual alteration, quotations, if anything, being fractionally higher than as last reported.

Iron and Steel.

Influenced by rumours of a further pending rise in Midland brands of foundry iron, buying interest in this section showed indications of revival and some fair additions have been made to blast-furnace order books. Lancashire foundries which are reasonably busy adding to the tonnage which they have to draw against. The rumours were substantiated on Tuesday of this week by the operation of a new price scheme which has been subscribed to by pig iron makers in the Midland counties.

Briefly, the scheme provides for quotations on a zone basis, with Derbyshire iron at 71s. per ton, delivered Manchester or equal distance, and Staffordshire at 73s. 6d., these prices representing increases of 6d. and 1s. a ton respectively, compared with those current up to the beginning of this week. Middlesbrough foundry iron is unchanged at 80s. per ton, with Scotch slightly firmer at about 90s., and hematite at 84s. 6d. to 85s., all delivered in the Manchester area. Contract buying of constructional steel materials has been on a quieter scale, users, apparently, having covered themselves far enough ahead. There is, however, still a fair weight of business being placed in boiler plates for locomotive builders and boilermakers, in general plates and in small bars, with prices very firm in all directions. Small re-rolled bars are maintained by Lancashire firms at last week's advance to £8 5s. per ton in 10-ton lots and £8 7s. 6d. in smaller quantities. Sections are at £7 17s. 6d., general plates at £8 12s. 6d., basic boiler plates at £9 12s. 6d., and acid varieties at 5s. premium, and large bars, 3in. and upwards, at £8 17s. 6d. per ton.

Manchester Association of Engineers.

A paper, entitled "Improvements in Driving Textile Mills," was read before the Manchester Association of Engineers on Thursday, the 7th inst., by Mr. F. B. Holt. The paper is confined to the driving of cotton spinning and cotton spinning and manufacturing mills, the latter being mills in which both spinning and weaving are carried out. An interesting section of the paper is that in which the relative advantages of private plant and public supply are analysed. The author states that in Lancashire the average price per unit of electricity from the public supply companies is now about 0·65d., and says that there is every possibility that in the near future the price will be reduced to 0·5d. per unit. There are certain districts in which for loads of 800-kW and upwards electricity can be purchased at 0·4d. per unit. In connection with electric driving, the author asserts that ultimately the individual drive will displace all other forms, owing to the demand in the cotton trade for increased production and higher quality of products. Many textile machinists are now completely re-designing their machines and making them suitable for individual motor drive, so that in the future the motor will form part of the machine. The paper is illustrated by drawings and photographic reproductions.

BARROW-IN-FURNESS.

Hematite.

From a maker's point of view, the position in the hematite pig iron market is improving. In the first place, the prices which are now being obtained allow of a small margin, a condition of things which did not exist when the lower prices were in force, and, secondly, stocks are coming down, and as a result the producer is placed in a better position. When stocks are practically wiped out, it is possible that the present output may hardly meet requirements, providing the present volume of trade is maintained. The possible stoppage in the steel-producing departments might balance matters, but it is hoped that the rail mills will be kept going for some time yet. Makers will be careful before they commit themselves to bigger production by putting in more furnaces, but there is a possibility of production being increased in Cumberland. There is still a slight hesitancy on the part of some buyers to place orders in view of the enhanced prices, but it is possible that it will break down soon, especially in view of the prospect of a further stiffening. The continental business continues steady and shipments are regular. There was another dispatch to Philadelphia last week from Barrow. The iron ore trade continues to be a little brisker, and there is more material going out of the district. The outlook is fairly good in the general business in foreign ores. The steel departments are still engaged upon railway material, but competition is keen and prices are ruling low in consequence. Prospects are at the moment only moderate, and orders would be welcome in both Barrow and Workington. The hoop mills at Barrow are busy and are likely so to remain.

SHEFFIELD.

(From our own Correspondent.)

An Improving Position.

A FAIR amount of general work in the steel trades has been booked during March, and although employment in the various branches is very unequal, there is a tendency to improvement, and the aggregate turnover for this month is likely to show an increase on that of February. Basic steel continues to command a ready sale, and the plants engaged in its production are on full-time work. There is not much progress to report in regard to acid steel. This fact is mainly due to the shortage of railway work, and while the British railway companies are expected to place good contracts after the quarter is turned, it is not anticipated that the volume of work from them will reach the level of former years. The inquiry for better class heavy steels shows some advance. Wagon-building work for private owners is very scarce. A fairly steady trade in tool steel is reported, but although there are numerous orders for small quantities, they do not relate in any large measure to the more expensive sorts, for which the demand is poor.

Increased Steel Production.

The figures of steel production for January, which are the latest to hand, show an improvement in both the Sheffield and Lincolnshire areas. The output in the Sheffield district was 103,700 tons, as compared with 76,900 tons in January, and 81,900 tons in January of last year. It was basic steel which accounted for the increase, the month's figure for that variety being 57,500 tons, while acid only reached 37,600 tons. Lincolnshire's production in January was 51,200 tons, as against 41,100 tons in January, and 38,000 tons in January, 1928. Lincolnshire also produced 66,000 tons of pig iron, as compared with 63,500 tons in December and 55,700 tons in the previous January. There is a strong demand for scrap suitable for use in basic furnaces, and as some classes of this material are scarce, prices have stiffened. Old cast iron is also well called for, and there is an improving position for high-grade steel scrap.

Enterprise and Progress.

The steel-melting plants of several of the largest firms in the district—Vickers-Armstrongs, John Brown and Co., the Parkgate Iron and Steel Company, and Cammell Laird and Co. at Penistone—are producing greater tonnages than they have recorded for a considerable time, which shows that the finished departments at these works are busier. Vickers-Armstrongs and Browns, who specialise in the new process of hollow rolling drums for high-pressure boilers, are receiving a large amount of valuable work in that department. The forgings consume a considerable quantity of steel. Mr. Alec Williamson, a director of Vickers-Armstrongs, speaking at a dinner of the Vickers No. 1 Branch of the Iron and Steel Trades Confederation on Saturday, mentioned that the firm had made ingots for the biggest boiler drums that had ever been made in the world, and had recently had orders for the biggest high-pressure boiler installation that had ever been erected in the British Empire. He mentioned other instances of the firm's enterprise. He said that they had been suffering from foreign competition in heavy forgings, and had recently set out to prevent, as far as possible, foreign forgings coming into this country. They had gone out and obtained orders for practically all the marine shafting which had recently been placed in this country. They had secured big orders from the Clyde, Belfast, Tyne, Tees, and the Hartlepools. With the help given by the workpeople in the melting department, they were very closely approaching the base continental prices, and were hoping very shortly to beat them. They had also gone into research work in connection with the production of moulds for centrifugally casting iron pipes, and had met with success. This was a business which, up to last year, was in the hands of the Americans. The firm had succeeded in producing moulds which gave very much greater life than any American mould.

Destroyer Orders.

To the list of Admiralty orders recently secured by firms having their headquarters in Sheffield is now to be added an order for two destroyers, received by John Brown and Co., of Sheffield and Clydebank.

Sheffield and the British Industries Fair.

In the cutlery and plate branches conditions on the whole are quiet. So far as this year has gone, the aggregate sales have not equalled those of last year. While some firms are well placed, the majority are in need of orders, and a number of women operatives belonging to the plate department are unemployed. A good deal of criticism has been directed to the fact that, at the British Industries Fair in London, the Sheffield silver trade was not represented, and only four cutlery firms of repute had stands, whereas Birmingham firms made a special show of those classes of goods. It is stated that Birmingham's big effort to capture Sheffield's spoon and fork trade has made considerable progress as a result. The experience of the Sheffield firms which did take space at the Fair is said to have been highly satisfactory. One firm, it is reported, booked orders running into several thousands of pounds; another well-known house, apart from ordinary business in known lines, obtained orders to the extent of hundreds of pounds for a little device known as cocktail sticks, for the United States; and millions of safety razor blades were sold. It is maintained, however, that this business is nothing in comparison with what could have been secured if Sheffield had organised an important section devoted to its cutlery and silver trades, instead of leaving them to be displayed on a few stands which were almost lost in the miles of ground covered by the Fair. A Sheffield manufacturer, when asked why the city failed to take advantage of such opportunities to advertise its skill, said that they could not afford it. Money was tight: they could not collect accounts; there were many firms so financially embarrassed that they could not afford to spend the money necessary to arrange an exhibition of their products. There was also, he said, another aspect of the situation. They found that there was a tendency to ignore exhibitions, and even displays in stock rooms, customers preferring the personal call from a firm's representative.

A Lead Ore Discovery.

The discovery of a rich vein of ore is reported at the Mill Close lead mine, near Matlock, the third largest lead mine in the country. The official report last year stated that the main veins had been worked out, but fresh ground was being explored. The newly found vein is below water level, and electric pumps have been installed, which are pumping out 10,000,000 gallons weekly. Ore is now being mined, and there is a prospect of a renewal of the mine's former prosperity. Some 400 miners had been discharged, but employment is now being gradually found for them.

NORTH OF ENGLAND.

(From our own Correspondent.)

Cleveland Iron Trade.

THE need for an expansion of output of pig iron in this area is now generally recognised. Some of the steel makers have scarcely sufficient iron for their own needs, and other consumers have difficuty in getting early deliveries, however pressing their requirements. The present stringent situation is causing considerable anxiety. Fewer than half of the blast-furnaces in this area are in operation, but the number blowing may be increased by four towards the end of this month. The furnaces to be rekindled shortly are two at the Jarrow Works of Palmer's Shipbuilding and Iron Company, and two of the Dorman group on Tees-side. Of the latter, one is expected to be at Port Clarence and the other at Newport. Both firms intend to run one new furnace on Cleveland and the other on hematite. At present there are thirty-six blast-furnaces in operation, seven of them making Cleveland pig iron, nine hematite, and twenty basic, ferro and other special irons. Meanwhile there is a strong demand for all classes of pig iron, and buyers are prepared to negotiate forward contracts on a substantial scale. Makers' fixed minimum quotations are unchanged, but firm. No. 1 foundry is 69s. 6d.; No. 3 G.M.B., 67s.; No. 4 foundry, 66s.; and No. 4 forge, 65s. 6d.

Hematite Pig Iron.

Stocks of East Coast hematite pig iron have been entirely liquidated, and business is so brisk that prices are still moving upward. Home and export consumers are pressing for larger supplies. Manufacturers are understood to have made substantial sales, and some of the contracts that have just been entered into are stated to be for delivery over periods up to the end of the year. Producers have no arrangement fixing quotations, and individual bargainings result in sales on terms that vary a good deal, but the basis of market values is now in the neighbourhood of 73s. 6d. for ordinary qualities and 74s. for No. 1 quality.

Ironmaking Materials.

Consumers of imported ore are very reluctant to follow the rise in quotations, and transactions are limited, but merchants look for further upward movement. Prices are ruled by best Rubio at fully 23s. c.i.f. Tees. There is a threatened shortage of Durham blast-furnace coke. A large forward business has been put through, and local consumers are seeking to cover their requirements to the end of the year. Spot lots command high figures, and for any delivery it is now difficult to purchase good medium kinds at below 19s., supplied to the works in this area.

Manufactured Iron and Steel Trade.

There is a steady increase in the activities of the Northern manufactured iron and steel works, though maximum output has not yet been attained. Firms producing finished iron have excellent order books, and report demand on a fairly heavy scale. Inquiries are still numerous and heavy in the steel trade. Output of shipbuilding material is heavier than for many years past, while demand for other constructional steel continues on the up grade. Consumers have almost ceased to buy foreign semis, and orders are being diverted to local works. Greater interest is now being taken in the scrap market. There is a pronounced scarcity of heavy steel scrap, and 63s. 6d. is offered as a delivered price without attracting adequate supplies. Heavy cast iron ordinary quality is steady at 62s. 6d., but machinery quality is rather firmer at 66s. per ton. Heavy steel turnings are also scarce, with the price at 53s. 6d., whilst cast iron borings have advanced to 50s. Heavy wrought piling scrap is worth 65s. 6d., and special heavy forge iron 70s., all these prices being delivered at works.

The Coal Trade.

The Northern coal trade outlook continues to provide encouragement all round. There are improving weather reports from the Baltic and other parts of Northern Europe, and vessels which have been detained through ice in Scandinavia are now on the move again. In steams and other coal there is more business than can be executed this month, so it is in every way probable that there will be a considerable carry-over of orders into April. This fact, coupled with the increasing demands and expected big rush for supplies from the Baltic ports, gives a decidedly strong tone to the forward market. Values of best Northumberland steams are firmly upheld under a vigorous and widespread demand. Durham large steams are similarly steady, and all brands of smalls find a ready trade at recent figures. Gas fuel is tending better, although prices remain at the late range. One of the features at the moment is the strong demand for bunker coals. A very large amount of Durham fuel now goes regularly to the coaling stations and to the big continental ports for liners, and, in addition, there are the requirements of steamers at local ports, where shipments are now on a very large scale. Ordinary qualities are selling freely at 15s., and the higher grades up to 16s. 6d. Some of the collieries have little to offer for prompt; if they had they could improve on earlier contract prices. Influenza among miners is dying down, and production is nearer the normal, although disputes at one or two collieries are stopping output at a time when the demand for it is very insistent. Coking coal values are maintained, and the trade is in considerable volume. On the export side there is sustained activity, and the run on this fuel is having a beneficial effect on coke prices. With more blast-furnaces likely to be restarted, the possibility of a shortage of coke is not remote. The demand is increasing, and the production at the ovens is quickly absorbed. There is a sustained inquiry for patent foundry cokes for export, and the ordinary qualities are steady at 22s. to 24s., and the special kinds at 25s. to 28s. Gas coke is unchanged at 21s.

Work for Tyneside.

The enterprise of Sir W. G. Armstrong, Whitworth and Co., Ltd., in building a new boiler shop at their Scotswood Works is proving its justification, as the shop is now very busy. The firm has just received an order for forty-six superheater boilers, cylinders, motion and other parts of locomotives for the Indian State Railways in face of keen home and continental competition. Another important contract placed with the firm is that of the Central Argentine Railway Company, Ltd., for the construction of twenty heavy locomotives.

SCOTLAND.

(From our own Correspondent.)

Fair Activity.

So far as the steel and iron trades are concerned markets are moderately active, and the outlook is viewed with a fair measure of confidence. No important developments are reported, apart from the resumption of work in the wrought iron trade after a stoppage lasting several weeks. The coal market is still very firm, supplies continuing scarce and prompt business extremely difficult to conclude.

Shipbuilding Contracts.

An order has been placed with the Greenock Dockyard Company, Ltd., Greenock, for a cargo steamer of about 10,600 tons, on behalf of the Clan Line Steamers, Ltd., Glasgow and London. This vessel will be a sister ship to the "Clan Macpherson," launched recently by the same builders. Four motor ships of 1500 tons each are to be built to the order of the Argentine Navigation Company (Nicolas Mihanovich), Ltd., of London and Buenos Aires.

Steel and Iron.

Steel makers report a somewhat quieter demand for plates and sections, but production has not slackened to any extent. Sheet makers have fair specifications for sheets of the lighter gauges. Galvanised sheets are improving, and prices are inclined to strengthen, owing to dearer costs of raw materials. Re-rolled steel is comparatively busy, and the price is firm at £8 per ton home and £7 15s. per ton export. Steel makers continue to experience difficulty in securing sufficient quantities of continental semis. The bar iron works are moderately busy, owing partly to some accumulation of orders over the stoppage caused by the dispute. Tube makers report little change, hot rolled and butt welded descriptions being busy. The demand for pig iron does not show much improvement, and as a rule supplies are ample.

Minimum Prices of Pig Iron.

It is reported that the price arrangement recently concluded will continue until April 3rd this year. Minimum prices are as follows:—No. 3 pig iron, 72s. 6d. at furnaces; Nos. 1 and 2, not less than 2s. 6d. per ton more than for No. 3; No. 4, 1s. per ton less than for No. 3; No. 4 forge iron for steel and malleable iron works, 72s. 6d. per ton delivered; basic iron, 72s. 6d. per ton delivered steel works.

Exports and Imports.

During the past week 8000 tons of iron ore, 1800 tons of steel and iron, and 2000 tons of pig iron were unloaded at Glasgow Harbour. Shipments of steel and iron totalled 2500 tons and pig iron 593 tons.

Coal.

There has been no change of importance in the Scottish coal trade. Owing to less severe weather conditions, the pressure for home supplies has not been quite so heavy, but demands are still considerable. The position of the collieries as regards export fuel is still unchanged, the scarcity of fuel being acute. Supplies for prompt shipments cannot be obtained, and the small lots becoming available realise very firm prices. The collieries in all districts are, in fact, almost fully sold for some weeks ahead, in some cases well into April. Some pits have been restarted, but the effect on supplies is not yet apparent. Aggregate shipments for the past week amounted to 254,079 tons, against 227,751 tons in the preceding week and 203,868 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Conditions.

THE position so far as the steam coal trade is concerned continues to be a strong one, and there appears to be no likelihood of any immediate falling away. On the contrary, the prospects are that the conditions will maintain round about their present activity, provided tonnage is satisfactory, until the end of April, while those who are optimistic enough to look for firmness up to the middle of the year are not without reason for this, as there is no doubt that many collieries have extremely good order books right up to that date. While current prices for best Admiralty large coals are quoted up to 21s. 6d., it is reported that one of the collieries producing these qualities has sold supplies up to August next at 20s., which is a very satisfactory figure. The policy of booking up sales as far ahead as possible will probably prove the right one, as it must be recognised that the present demand is stimulated by the fact that continental producers are handicapped by reason of the transport and shipment of their coals being interrupted by the recent cold weather. It is reported that even now shipments have not been resumed on any material scale at Rotterdam, but when the conditions on the Continent do become normal, it is only natural to look for a diminution in the demand from this country. The uncertainty, however, has compelled buyers abroad to take no risks, and consequently very considerable business has been placed for Welsh coals for shipment over the next few weeks particularly. The trouble with many undertakings is that they cannot produce sufficient coals to meet their immediate obligations. According to the Great Western Railway Company, the quantity of coal and coke shipped at local docks under its control for the week ended the 10th inst., was 655,645 tons, as compared with 641,144 tons durng the preceding week and formed the highest total shipped since the week ended May 28th, 1927. It is too much to expect that this figure will be maintained, as the arrangement by which two hours' work was added to each shift came to an end on Saturday. Under that temporary agreement, it meant that work was carried on at local docks for twenty hours out of every twenty-four, and its object was achieved, as the congestion was relieved, as is shown by the returns. On Saturday last there were twelve tipping appliances idle at the various South Wales docks and only six steamers were waiting. Arrivals of tonnage over the week-end converted the position into one tipping appliance being idle, while seventeen steamers were waiting to berth. There is every indication of considerable loading pressure being experienced during the next fortnight, and immediately following the holidays, as the chartering of tonnage continues to be active, the quantity of tonnage taken up during the week ended the 8th inst. being over 400,000 tons, while the week before that it was over half a million tons, this being well above the average. Apart from the good general demand, the Greek State Railways have bought one or two cargoes of superior Admiralty large coals, and the Algerian State Railways are reported to be in the market for about 40,000 tons of patent fuel for delivery over the next five months.

Aftermath of the Frost.

One of the results of the severely cold weather which was experienced in this district from February 11th and later was the crop of problems which arose as between shipowners, coalowners and coal exporters on the question of demurrage. It will be recalled that at one time just over a hundred steamers were waiting in South Wales docks, and following the usual practice coal exporters and coalowners claimed an extension of loading hours, owing to the fact that work was held up. Shipowners, in turn, sent in their claims for demurrage. The settling of such claims by any general principle was almost impossible, owing to the varying circumstances governing individual cases, the reason being that as time went on resumption of work was gradual, coal tipping taking place at one dock while it might still be completely interrupted at others. The problems were recognised to be so difficult that the Cardiff Chamber of Commerce called a meeting of its members at the end of last week, when all parties interested gave expression to their views, with the object of assisting all concerned. One suggestion put forward was that a fair solution would be for all claims for demurrage to be settled on a "fifty-fifty" basis, but eventually it was decided to recommend to all parties that they should show a spirit of mutual compromise.

Monopoly of Anthracite Coals for Paris?

Some perturbation has been caused, both in this district and in France, by the report that a project is contemplated for the centralisation of the purchase and distribution of Welsh anthracite coals for the Paris market. It is understood that the idea is to form a new French syndicate representative of a number of French importing firms, and for that syndicate to have the sole rights to receive at ports between Dunkirk and Caen inclusive coals produced by the Amalgamated Anthracite Collieries, which, as is well known, control over 80 per cent. of the production of Welsh anthracite. French importers who are not in the proposed new French syndicate naturally are opposed to the move, and exporters on this side are also somewhat alarmed. The matter came up for discussion at a meeting of the Swansea Chamber of Commerce on Monday, when a deputation was appointed to wait upon Sir Alfred Cope, of the Amalgamated Anthracite Collieries, in order to discuss the matter with him.

Tin-plate Regulation.

The adoption of a scheme on the pooling basis, to replace the "stop week" scheme, is now reported officially, the latter having proved rather unsatisfactory, as despite stoppages of three weeks in every quarter, overproduction during the working periods was not stopped. The new scheme provides for an allocation of percentage quotas to the various mills, based on the monthly output of each mill during the year ended November 24th last, which was a completed year under the old system. A penalty is to be enforced of 2s. per box for production in excess of the permitted quota, and it is proposed to compensate at the same rate those makers who produce less than their permitted quotas.

Current Business.

The tone of the steam coal market throughout is very firm. Most collieries have no coals to sell for the remainder of this month, and in some cases they cannot take on any further commitments even for the whole of April. The price of best Admiralty large coals ranges up to 21s., and second qualities are 20s. to 20s. 6d. Smalls are strong, and easily command up to 14s. 6d. for superior descriptions, some salesmen quoting up to 15s. Coke finds a ready outlet and patent fuel is slightly better. Pitwood is steady on the basis of 27s. to 27s. 6d.

CONTRACTS.

THE D.P. BATTERY COMPANY, Ltd., of Bakewell, Derbyshire, has received through its Australian agents, T. K. Steanes and Son a repeat order for Kathanode traction batteries for use in Brisbane on road-craft trucks.

J. W. BROOKE AND CO., Ltd., of Lowestoft, have received from H.M. Royal Air Force an order for two Brooke "Seacars" for use as fast tenders in connection with the forthcoming International Schneider Cup Race.

DAVEY, PAXMAN AND CO., Ltd., of London and Colchester, have received from the Ashford (Kent) Urban District Council an order for an eight-cylinder 1500 B.H.P. "spring injection" solid injection crude oil engine for its electric generating station.

YARROW AND CO., Ltd., of Scotstoun, Glasgow, have received from the Brighton Corporation an order for two boilers, each of 75,000 lb. per hour capacity and for 350 lb. per square inch working pressure, the boilers to be equipped with superheaters, economisers and air heaters.

THE GENERAL ELECTRIC COMPANY, Ltd., has received orders from the Bo ough of Holborn and from (N.C.C.), Belfast, for twelve months' requirements of Osram gas-filled and vacuum lamps, and an order from the London, Midland and Scottish Railway for twelve months' requirements of Osram gas-filled vacuum and train-lighting lamps, &c.

SIR W. G. ARMSTRONG, WHITWORTH AND CO., Ltd., have received an order from the Central Argentine Railway Company, Ltd., for the construction of twenty heavy 4–8–4 locomotives. These engines, which will weigh in running order over 123 tons each, will be built at the Scotswood Works, Newcastle-upon-Tyne, and delivery is to be completed in thirty-four weeks.

GREAT WESTERN RAILWAY has officially announced that the following contracts have been placed:—(*a*) Supply and delivery of eleven six-cylinder "B.C. Forward" chassis, J. I. Thornycroft and Co., Ltd., Thornycroft House, Smith-square, S.W. 1; (*b*) cleaning and repairing station buildings at Old Hill, Windmill End, and others, Fillers, Ltd., Nottingham; (*c*) cleaning and repairing station buildings at Llandrillo, Balo Junction, and others, Alfred Bagnall and Sons, Ltd., Shipley; (*d*) cleaning and repairing station buildings at Aronig, Festiniog, and others, Alfred Bagnall and Sons, Ltd., Shipley; (*e*) construction of a loopline near Tonteg Halt, Llantrisant Branch, Mr. H. Smith, Newport; (*f*) new waiting rooms and platform covering, Westbourne Park Station, W. Walkerdine, Ltd., 115A, Walmer-road, W. Kensington, W. 10; (*g*) provision of new refreshment kiosk, Cardiff Station, Wm. T. Nicholls, Ltd., Gloucester; (*h*) extension of Goods Station at Leamington Station, C. H. Heston, Ltd., Brierley Hill; (*i*) provision and installation of pneumatic tubes at Birmingham (Snow Hill), The Lamson Pneumatic Tube Company, Ltd., 132, Cheapside, London, E.C. 2; (*j*) reinforced concrete work to carry a new coal hoist and traverser track, North-East end, Queen Alexandra Dock, Cardiff, Peter Lind and Co., Ltd., 2, Central-buildings, Westminster, S.W. 1; (*k*) repairs for the overhaul of grab dredger "Basingstoke," The Tredegar Dry Dock and Wharf Company, Ltd., Newport, Mon.; (*l*) repairs to ferry steamer "The Mew," The Bickle Engineering Company, Ltd., Plymouth; (*m*) repairs to ss. "Roebuck," John I. Thornycroft and Co., Ltd., Thornycroft House, Smith-square, S.W. 1; (*n*) repairs for the overhaul of dredger "David Davies," Harris Bros., Ltd., Swansea; (*o*) repairs to "St. Helier," John I. Thornycroft and Co., Ltd., Thornycroft House, Smith-square, S.W. 1; (*p*) supply and erection of two Kinnear patented steel rolling shutters for the refuse destructor at Old Oak Common; Arthur L. Gibson and Co., Ltd., Twickenham; (*q*) supply and delivery of oxygen jet cutting machine for "AM" Shop Locomotive Works, Swindon, The British Oxygen Company, London; (*r*) supply and delivery of "Maxicut" piston valve spindle lathe for "AM" Shop Locomotive Works, Swindon, Drummond Bros., Ltd. Guildford; (*s*) supply and delivery of ironing machine for No. 10 (Laundry) Carriage and Wagon Works, Swindon, Manlove, Alliott and Co., Ltd., London; (*t*) supply and delivery surfacing and boring lathe for Worcester, Dean, Smith and Grace, Ltd., Keighley; and (*u*) supply and delivery of four low-loading trailers for container work, The Harrow Industrial Company, Ltd., South Harrow, Middlesex.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

THE Italian Naval Attaché desires us to announce that the address of his office is now Flat 7, 3, Hans-crescent, London, S.W. 1. Telegraphic address, Navitalia, Knights, London; and telephone, Sloane, 1385.

RILEY STOKER Co., Ltd., of 9, Bridge-street, London, S.W. 1, asks us to announce that, owing to ill-health, Mr. Charles Erith has resigned his position of managing director of, and has severed his connection with the company. Mr. J. O. Murgatroyd, who is chairman, and one of the originators of the company, has taken over the management of the business.

THE BRITISH ALUMINIUM COMPANY, Ltd., the head office of which is at Adelaide House, King William-street, London, E.C. 4, asks us to announce that it has now opened a new branch office and warehouse at 66, Kirkstall-road, Leeds, which will be under the management of Mr. C. F. Batstone. Telegraphic address: "Aluminium, Leeds," and the telephone number Leeds 28343.

MESSRS. HERBERT HUNT AND SONS, of Elsinore-road, Old Trafford, Manchester, ask us to announce that they have purchased the sole manufacturing rights of the Pearns tappers—until recently manufactured by Smith and Coventry, Ltd., of Manchester—along with the plant and stock of tappers, &c., and will carry on the manufacture of these tappers at their own works.

DR. E. W. SMITH, technical director of the Woodall-Duckham Companies, has been appointed chief technical officer (unpaid) of the Area Gas Supply Committee of the Board of Trade, following the appeal by the President, the Right Hon. Sir Philip Cunliffe-Lister, to the industries concerned that they should lend expert *personnel* for the work of the Committee. Dr. Smith will continue to act as technical director of the companies with which he is associated, his work for the Committee taking up a portion of his time only.

COCKATOO ISLAND DOCKYARD.—We are informed that the Commonwealth Government of Australia is prepared to receive tenders for the lease of Cockatoo Island Dockyard as a going concern. The latest time for tenders to be lodged, either at the offices of the High Commissioner for Australia, Australia House, Strand, or at the offices of the Prime Minister for Australia, Canberra, is noon on March 30th.

THE ASSOCIATION OF SPECIAL LIBRARIES AND INFORMATION BUREAU.—Members of the Aslib and their friends are invited to attend a public meeting which has been arranged jointly by the Association and the Library Association. The meeting will be held on Wednesday, March 27th, at 6.30 p.m., at the London School of Economics, Houghton-street, Aldwych, W.C. 2. Mr. C. R. Sanderson (librarian of the National Liberal Club) will speak on "Are Libraries Doing their Job?" A discussion will follow the lecture. Mr. B. M. Headicar (librarian of the London School of Economics) will be chairman of the meeting, and he has offered to show members over the new buildings of the school, including the library, before the meeting. Those who wish to take advantage of this invitation should meet Mr. Headicar in the entrance hall of the school at six o'clock.

LAUNCHES AND TRIAL TRIPS.

LADY MEATH, twin-screw steamship; built by Ardrossan Dockyard, Ltd., to the order of British and Irish Steam Packet Company, Ltd., Dublin; dimensions, 320ft. by 40ft.; to carry cargo. Engines, two sets triple-expansion; constructed by J. G. Kincaid and Co., Ltd.; launch, February 28th.

MELROSE ABBEY, single-screw passenger and cargo steamer; built by Earle's Shipbuilding and Engineering Company, Ltd., to the order of the Hull and Netherlands Steamship Co., Ltd.; dimensions, 280ft. by 38ft. by 18ft. 3in.; to carry passengers and cargo. Engines, triple-expansion, 21½in., 37in. and 64in. by 42in. stroke, pressure 220 lb. per square inch; constructed by the builders; launch, February 28th.

MANIPI, motor vessel; built by the De Maas Shipbuilding Company, to the order of the Royal Mail Packet Company, of Amsterdam; dimensions, 165ft. by 28ft. 8in. by 10ft. Engines, Sulzer motor of 250 B.H.P.; launch, recent.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
(1) Native	17/6 to 19/-
(1) Spanish	21/-
(1) N. African	21/-
N.E. COAST—	
Native	18/- to 21/-
Foreign (c.i.f.)	23/-

PIG IRON.

	Home. £ s. d.	Export £ s. d
(2) SCOTLAND—		
Hematite	—	—
No. 1 Foundry	3 15 0	—
No. 3 Foundry	3 12 6	—
N.E. COAST—		
Hematite Mixed Nos.	3 13 6	3 13 6
No. 1	3 14 0	3 14 0
Cleveland—		
No. 1	3 9 6	3 9 6
Silicious Iron	3 9 6	3 9 6
No. 3 G.M.B.	3 7 0	3 7 0
No. 4 Foundry	3 6 0	3 6 0
No. 4 Forge	3 5 6	3 5 6
Mottled	3 5 0	3 5 0
White	3 5 0	3 5 0
MIDLANDS—		
(3) Staffs.—		
All-mine (Cold Blast)	—	—
North Staffs. Forge	—	—
,, ,, Foundry	3 5 0	—
(3) Northampton—		
Foundry No. 3	2 19 0	—
Forge	2 15 0	—
(3) Derbyshire—		
No. 3 Foundry	3 2 6	—
Forge	2 18 6	—
(3) Lincolnshire—		
No. 3 Foundry	3 2 6	—
No. 4 Forge	2 18 6	—
Basic	3 2 6	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 2 6 (a) / 4 6 0 (b) / 4 9 0 (c)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 10 0	—
Common Bars	10 5 0	—
Best Bars	10 15 0	—
Double Best Bars	11 5 0	—
Treble Best Bars	11 15 0	—
LANCS.—		
Crown Bars	10 10 0	—
Second Quality Bars	10 0 0	—
Hoops	13 0 0	—
S. YORKS.—		
Crown Bars	10 10 0	—
Best Bars	11 10 0	—
Hoops	12 10 0	—
MIDLANDS—		
Crown Bars	9 5 0 to 10 0 0	—
Marked Bars (Staffs.)	12 0 0	—
Nut and Bolt Bars	8 10 0 to 8 17 6	—
Gas Tube Strip	10 12 6	—

STEEL. (d)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	10 10 0	10 10 0
Ship Plates, ¼in. and up	8 7 6	7 12 6
Sections	7 17 6	7 2 6
Steel Sheets, ¼in.	8 15 0	8 12 6
Sheets (Gal. Cor. 24 B.G.)	13 10 0	13 12 6 to 13 15 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 7 6	—
Angles	7 17 6	—
Boiler Plates	12 15 0	—
Joists	7 17 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	7 15 0	—
Soft Billets	6 15 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 0 0	—
Light Rails	8 5 0 to 8 10 0	—
Billets	6 15 0 to 9 10 0	—
MANCHESTER—		
Bars (Round)	8 17 6	—
,, (Small Round)	8 5 0 to 8 7 6	—
Hoops (Baling)	10 0 0	9 15 0
,, (Soft Steel)	9 0 0	8 15 0
Plates	8 12 6 to 8 17 6	—
,, (Lancs. Boiler)	9 12 6 to 9 17 6	—
SHEFFIELD—		
Siemens Acid Billets	8 15 0 to 9 0 0	—
Hard Basic	8 15 0	—
Intermediate Basic	7 5 0 to 7 15 0	—
Soft Basic	7 0 0	—
Hoops	9 5 0 to 9 10 0	—
Soft Wire Rods	7 12 6	—
MIDLANDS—		
Small Rolled Bars	7 15 0 to 8 5 0	—
Billets and Sheet Bars	6 5 0 to 6 10 0	—
Sheets (20 W.G.)	11 10 0 to 12 0 0	—
Galv. Sheets, f.o.b. L'pool	13 10 0 to 13 15 0	—
Angles	7 17 6	—
Joists	7 17 6	—
Tees	8 17 6	—
Bridge and Tank Plates	8 12 6	—
Boiler Plates	9 15 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	18/- to 18/3
Block Tin (cash)	218 5 0
,, ,, (three months)	219 0 0
Copper (cash)	81 16 3
,, (three months)	83 2 6
Spanish Lead (cash)	23 5 0
,, ,, (three months)	23 11 3
Spelter (cash)	26 7 6
,, (three months)	26 16 0
MANCHESTER—	
Copper, Best Selected Ingots	90 10 0
,, Electrolytic	94 10 0
,, Strong Sheets	118 0 0
,, Tubes (Basis Price), lb.	0 1 3½
Brass Tubes (Basis Price), lb.	0 1 1½
,, Condenser, lb.	0 1 3½
Lead, English	25 2 6
,, Foreign	23 17 6
Spelter	26 17 6
Aluminium (per ton—raw ingot)	£95

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/11 per lb.	
Ferro Tungsten	1/9 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£22 0 0	7/6
,, ,, 6 p.c. to 8 p.c.	£21 10 0	7/-
,, ,, 8 p.c. to 10 p.c.	£22 0 0	6/-
,, ,, Specially refined		
,, ,, Max. 2 p.c. carbon	£32 0 0	12/-
,, ,, ,, 1 p.c. carbon	£38 0 0	15/-
,, ,, ,, 0·70 p.c. carbon	£42 0 0	17/-
,, ,, ,, carbon free	1/- per lb.	
Metallic Chromium	2/7 per lb.	
Ferro Manganese (per ton)	£13 15 0 for home	
	£13 10 0 for export	
,, Silicon, 45 p.c. to 50 p.c.	£12 0 0 scale 5/- per unit	
,, ,, 75 p.c.	£19 0 0 scale 6/- per unit	
,, Vanadium	13/6 per lb.	
,, Molybdenum	3/8 per lb.	
,, Titanium (carbon free)	1/- per lb.	
Nickel (per ton)	£170 to £175	
Ferro-Cobalt	9/6 per lb.	

FUELS.

SCOTLAND.
(Prices not stable.)

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	16/6
,, ,, Ell	19/-
,, ,, Splint	19/- to 19/6
,, ,, Trebles	17/6
,, ,, Doubles	16/-
,, ,, Singles	14/6
AYRSHIRE—	
(f.o.b. Ports)—Steam	17/6
,, ,, Jewel	18/6
,, ,, Trebles	17/6
FIFESHIRE—	
f.o.b. Methil or Burntisland—Steam	17/- to 18/6
Screened Navigation	19/6
Trebles	17/6 to 18/6
Doubles	17/- to 17/6
Singles	15/-
LOTHIANS—	
(f.o.b. Leith)—Best Steam	16/6 to 17/-
Secondary Steam	16/- to 16/6
Trebles	17/6 to 18/-
Doubles	16/6
Singles	14/9

ENGLAND.

	Inland.	Export.
(8) N.W. COAST—		
Steams		23/-
Household		39/6 to 52/-
Coke		23/-
NORTHUMBERLAND—		
Best Steams		16/6
Second Steams		15/6 to 16/-
Steam Smalls		10/6 to 11/-
Unscreened		14/-
Household		21/- to 27/-
DURHAM—		
Best Gas		15/- to 15/3
Second		14/6 to 14/9
Household		21/- to 27/-
Foundry Coke		22/6 to 25/-
SHEFFIELD—		
Best Hand-picked Branch	27/- to 28/6	—
Derbyshire Best Bright House	23/6 to 25/-	—
Best House Coal	21/- to 22/-	—
Screened House Coal	18/- to 19/-	—
,, ,, Nuts	17/- to 19/-	—
Yorkshire Hards	15/6 to 16/6	—
Derbyshire Hards	15/6 to 16/6	—
Rough Slacks	8/6 to 9/6	—
Nutty Slacks	6/- to 7/-	—
Smalls	3/6 to 4/-	—
Blast-furnace Coke (Inland)	14/6 at ovens	—
Furnace and Foundry Coke (Export), f.o.b.		21/- to 22/6

CARDIFF— (9) SOUTH WALES.

Steam Coals:	
Best Smokeless Large	21/- to 21/3
Second Smokeless Large	20/3 to 21/-
Best Dry Large	20/- to 20/6
Ordinary Dry Large	19/6 to 20/-
Best Black Vein Large	20/- to 20/3
Western Valley Large	19/9 to 20/-
Best Eastern Valley Large	19/- to 19/6
Ordinary Eastern Valley Large	18/6 to 19/-
Best Steam Smalls	14/6 to 15/-
Ordinary Smalls	13/- to 14/6
Washed Nuts	20/- to 25/-
No. 3 Rhondda Large	21/- to 22/-
,, ,, Smalls	15/- to 16/-
No. 2 ,, Large	18/6 to 19/-
,, ,, Through	17/- to 18/-
,, ,, Smalls	13/6 to 14/-
Foundry Coke (export)	27/- to 37/-
Furnace Coke (export)	19/- to 21/-
Patent Fuel	20/6 to 21/6
Pitwood (ex ship)	27/3 to 27/9
SWANSEA—	
Anthracite Coals:	
Best Big Vein Large	33/- to 35/-
Seconds	25/- to 29/-
Red Vein	22/- to 27/-
Machine-made Cobbles	40/- to 43/6
Nuts	36/- to 43/6
Beans	23/6 to 25/-
Peas	16/6 to 17/6
Breaker Duff	9/6 to 9/9
Rubbly Culm	11/- to 11/6
Steam Coals:	
Large	18/- to 19/-
Seconds	17/- to 18/-
Smalls	11/- to 13/-
Cargo Through	15/9 to 16/9

(1) Delivered. (2) Net Makers' Works. (3) f.o.t. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated. coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (a) Delivered Glasgow. (b) Delivered Sheffield. (c) Delivered Birmingham. (d) Rebate 12/6 joists and 10/- all other materials if home consumers confine purchases solely to British products.

French Engineering Notes.

(From our Correspondent in Paris.)

Reparations.

THE problem of German reparations has always been a subject of contention amongst French manufacturers, who accepted the importation of manufactured goods because it offered the only means of getting payment from the debtor country; but they insisted on the matter being managed with prudence and are now claiming the right to exercise a control over the supply of goods on account of reparations. Nevertheless, the German goods and material are serving a useful purpose in enabling the State to carry out a vast scheme of public works at home and in the Colonies and to increase thereby the country's economic importance. Home manufacturers benefit to a large extent from this activity. At the same time, there are complaints that some branches of industry are suffering from the importation of German goods, and manufacturers would welcome any change in the present system that would relieve them of the burden. This probably explains the rumours to the effect that, in the negotiations now being carried out for the final settlement of Germany's obligations towards the former allies, the conditions under which reparations are made are to be modified to the extent of enabling creditor countries to take larger quantities of material and manufactured goods and dispose of them in any way they please. If that were done it is quite easy to imagine that the French might accept foreign contracts to be executed with the aid of German material, and that would create a situation involving serious trouble, since it would introduce an element of unfair competition in foreign markets that must be highly detrimental to British interests.

Shipbuilding.

The launching of a ship in Great Britain for the Compagnie Transatlantique to be used in the Mediterranean service and the placing of an order with English shipyards by another French company for four Diesel engined boats have evoked some comment at a time when the home shipyards are wanting employment. It had been expected that the law put in operation last year for granting loans to shipowners to enable them to modernise their fleets would have provided work to shipyards, and the situation since then has certainly improved, but not to the extent that had been anticipated. Shipbuilders complain that they are suffering from the tonnage which is being supplied by Germany on account of reparations, while shipowners state that, except in the case of subsidised vessels, they have every interest in placing orders in Great Britain where costs are lower, presumably because there is more specialisation in shipbuilding. In France such specialisation is not possible, because there is not enough tonnage of particular types of vessels to allow of their being built in series. Costs are going up, both as regards wages and material, and it is becoming more and more difficult to compete with British shipyards. Everything has been done to help French shipbuilders by according them preferential rates for the carriage of raw material and the free importation of ship-plates and machinery under certain conditions; but the fact remains that the capacity of the shipyards is so much greater than what is required for home shipbuilding that full employment can only be assured by obtaining orders from abroad.

Paris Water.

There having been a few cases of typhoid fever in Paris, the Prefect of the Seine has issued a statement to the effect that they must be attributed to other causes than the water supply which, he says, is of a quality as good as that provided in any of the great cities. The method of sterilising the water by the addition of chlorine was started in 1911, when a dose of 10 grammes for 10 cubic metres of water was employed, but later on the dose was progressively reduced until now it varies from 1 to 1·5 gramme when the water is very clear, to 6 to 10 grammes when the water contains matter in suspension. There is nothing in the taste or appearance of the water to give rise to complaint.

Machine Tools.

The machine tool industry is steadily growing, and business is increasing as the result of the industrial organisation which is taking place with a view to realising economies and checking, as far as possible, the advancing production costs, due partly to the difficulty of procuring skilled labour. In every direction manufacturers are endeavouring to make the most of the labour available, and foreign production methods are closely investigated and adapted to French conditions. The demand for machine tools has been particularly good in the motor car industry, and users are now showing more confidence in the French machines, which for a long while failed to make headway against foreign machine tools, notwithstanding the much higher prices that had to be paid for the imported productions. Those prices have been still further increased by the existing duties, and, as French firms are turning out better machine tools, they are securing the bulk of the trade, except in special high duty machines, many of which are still bought in Great Britain. At the moment, there is a market in this country for any machines that help to solve the labour problem.

Colonial Exhibition.

Work is proceeding with the laying out of the International Colonial Exhibition, which will be held in 1931 in the Bois de Vincennes. It is hoped that the Exhibition will mark an epoch in colonial development by co-ordinating efforts and settling upon definite lines for the opening up of Colonies, especially in Africa. Recent experience has shown that there is still much to be done in the way of improving the colonial administration and development methods.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

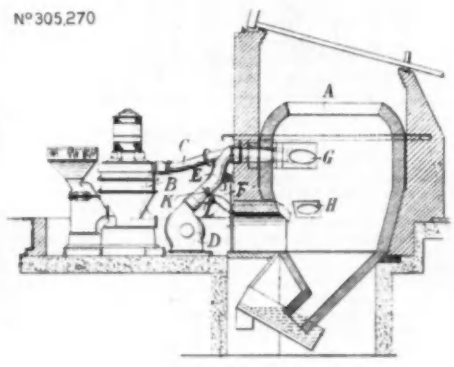
Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM GENERATORS.

305,270. November 1st, 1927.—COMBUSTION CHAMBERS, Frederick Lindley Duffield, of 11, Aldwych, London, W.C. 2.

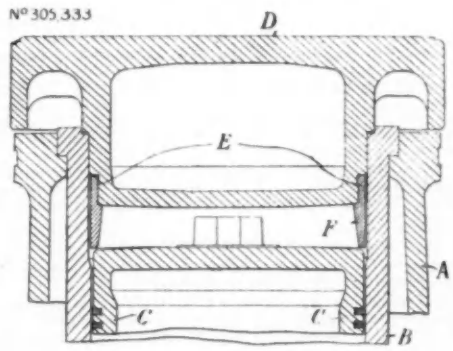
The combustion chamber A is a substantially pear-shaped chamber, B is a pulveriser, C a pipe through which fuel is conveyed from the pulveriser to the chamber A. Air is supplied to the chamber from a fan D through pipes E and F, entering the combustion chamber through inlets G H respectively arranged at different levels in the wall of the chamber. The pipe E surrounds that part of the pipe C which passes through the inlet G. The quantity of air passing into the chamber from the fan is proportioned between the inlets G H as desired by means of regulating valves K L in the pipes E and F respectively. In use powdered fuel and the requisite carrying air is introduced tangentially into the chamber A through pipe C with a velocity between 150ft. to 300ft. per second. Secondary air for combustion is delivered tangentially to the chamber through pipes E and F, also with a velocity between 150ft. to 300ft. per second, and by regulating the quantity of air supplied by the pipes E and F respectively the zone of combustion is raised or lowered within the chamber A.—*February 1st*, 1929.



INTERNAL COMBUSTION ENGINES.

305,333. December 19th, 1927.—CYLINDER CONSTRUCTION OF INTERNAL COMBUSTION ENGINES, Richardsons, Westgarth and Co., Ltd., and Walter Scott Burn, both of Hartlepool Engine Works, Hartlepool.

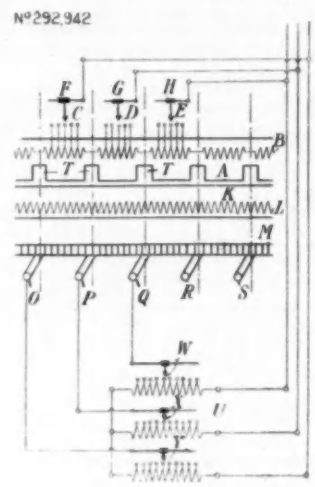
In engines generally known as the Diesel type in which the fuel charge is injected into the highly compressed air charge, the part of the cylinder liner where this occurs is the part subjected to the highest heat stresses, and it is here that the greatest heat losses from the cylinder occur. The object of this invention is to effect an improvement whereby the heat stresses and losses are minimised without creating other difficulties. The accompanying drawing illustrates the invention as applied to the cylinder cover of an engine. A represents the cylinder jacket, B the liner, C the piston, and D the cylinder cover, which is turned somewhat to the shape shown so that a ledge E is formed, which is engaged by a companion ledge upon the insulating ring F. The ring is heated and contracted on to the cover, the ledge arrangement referred to preventing detachment of the ring when hot. The ring F is composed of material that will resist high temperatures and can easily be renewed from time to time.—*February 7th*, 1929.



DYNAMOS AND MOTORS.

292,942. April 18th, 1928.—SINGLE AND MULTIPHASE COMMUTATOR MOTORS. Josef Sousedík, of Vsetín, Moravia, Czecho-Slovakia.

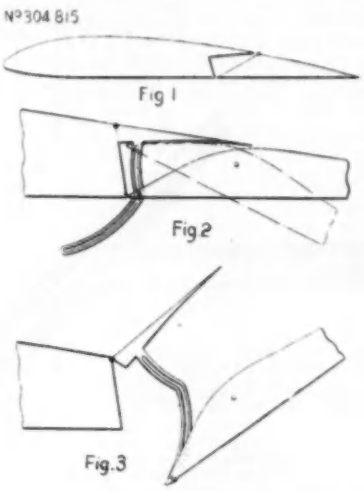
This invention relates to an improved single or multiphase commutor motor, the object being to provide a construction which will allow the speed of the motor to be readily regulated without any sparking taking place at the commutator, although the brushes are kept in a fixed position. The drawing illustrates the invention diagrammatically and by way of example as applied to a three-phase commutator motor. A is the stator which is provided with a winding B having three groups of tappings C, D, E. F, G, H, are three movable contacts of a controlling switch by means of which the phase is adjusted with respect to the rotor. K is the rotor which is provided with the usual winding L and commutator M. The brushes O, P, Q, &c., are kept in a fixed position on the commutator and the parts of the stator A facing the parts of the rotor K where the rotor windings L are short-circuited by the brushes, are radially recessed as shown at T, the width of the recesses corresponding to the width of the brushes. The brushes are connected to the supply circuit through the intermediary of an adjustable auto-transformer U or induction regulator, in order to obtain a gradual regulation. The starting of the motor is as follows:—Before the current is switched on the movable contacts W, X, Y, of the transformer are moved entirely to the right. In this way the voltage of the outer transformer corresponds to the voltage induced in the rotor of the machine. Next the movable contacts are moved to the left, whereby the voltages in the transformer and rotor are reduced and the speed of the motor is increased until synchronism is attained. In the case of an induction regulator the speed is increased even beyond synchronism.—*February 7th*, 1929.



AERONAUTICS.

304,815. October 26th, 1927.—CONTROL SURFACES FOR AIRCRAFT, The Bristol Aeroplane Company, Ltd., and L. G. Frise, Filton House, Bristol.

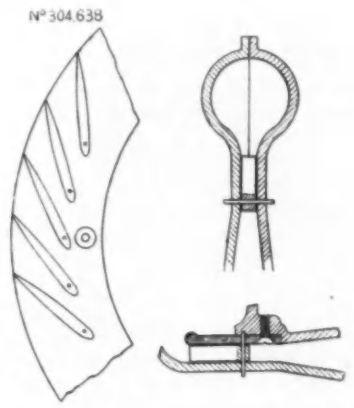
The first claim in this specification is for a combination of aeroplane and aerofoil, which can be moved in relation to one another and yet retain, as is shown in Fig. 1, a reasonably good stream-line form. It is also suggested that the plane should be provided with a hinged extension, as shown in Figs. 2 and 3, so connected with the nose of the aerofoil by a link that, when the aerofoil is tilted upward, a fair gap will be provided for the passage of a current of air towards the upper side of the aerofoil.—*January 28th*, 1929.



PUMPING AND BLOWING MACHINERY.

304,638. September 21st, 1927.—CENTRIFUGAL BLOWERS, N. S. Muir, Royal Aircraft Establishment, South Farnborough, Hants.

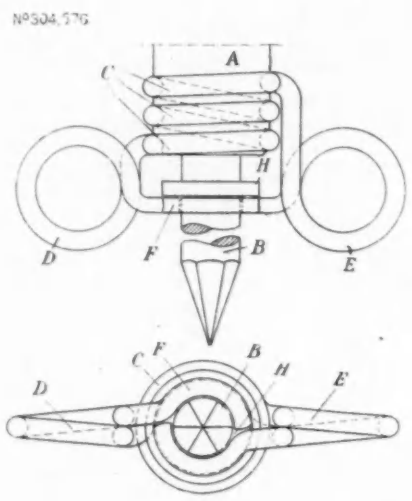
The inventor suggests that the efficiency of a centrifugal blower may be improved by providing it with diffuser vanes which are pivotally mounted so as to move freely under the fluid forces, and are of stream-line or aerofoil section. The illustration needs no comment.—*January 21st*, 1929.



MACHINE TOOLS AND SHOP APPLIANCES.

304,576. August 13th, 1928.—HOLDING SPRING FOR PERCUSSIVE PNEUMATIC TOOLS, Carl Middermann, of 76, Haldenerstrasse, Hagen, Germany, and Friedrich Weidemann, of 32, Wittekindstrasse, Hagen, Germany.

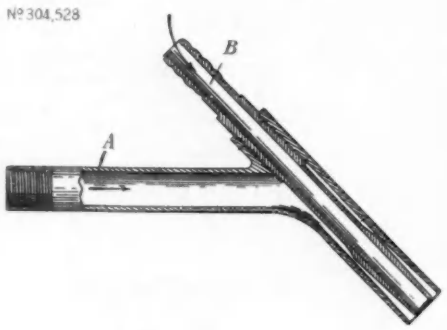
This specification describes a holding spring for percussive pneumatic tools. The tool B moves in the cylinder A in the usual manner. In the cylinder head is cut a thread, designed to accommodate the turns C of the spiral-shaped holding spring. The spring has two opposite laterally projecting windings D



and E, situated in one and the same plane. The two free ends of the spring wire are each bent to form an approximately semi-circular collar F, which leaves sufficient space for the passing of the tool, and it forms an abutment for the collar H of the tool. The collar F may be pressed flat or it may preserve its round cross section. The spring can easily be pulled in lateral directions, so that the collar F is widened and the collar of the tool can pass through so that the tools can be changed without removing the holding spring.—*January 24th*, 1929.

304,528. April 12th, 1928.—SAND BLAST APPARATUS, A. Gutmann, Altona-Ottensen, Germany.

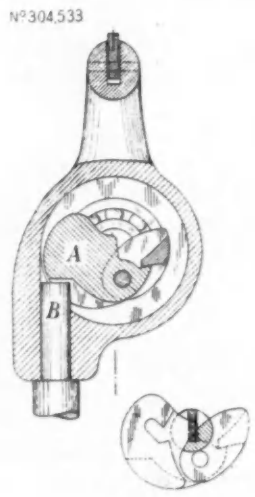
In this specification it is suggested that the maximum effect of sand-blasting nozzles has not heretofore been attained on account of the fact that the passages for the air decreased con-



tinuously towards the outlet The inventor consequently adopts the form shown in the illustration, which he describes as being similar to that of a de Laval nozzle. The compressed air is supplied to the branch A, and the abrasive sand at B. It will be noticed that, towards the outlet, the annular air passage has an expanding area.—*January 24th*, 1929.

304,533. April 20th, 1926.—A MECHANICAL HAMMER, J. S. Moller, Bülowsvej 12, Frederiksberg, by Copenhagen, Denmark, and H. Nielsen, Ingemannsvej 9, Frederiksberg.

This percussion hammer is, as will be seen from the drawing, of a more or less familiar general form. The hammer A is thrown

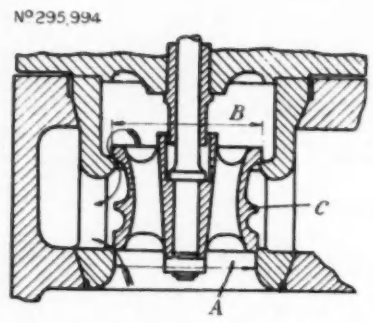


against the head of the tool B, and consequently strikes a blow. The peculiarity of the arrangement lies in the fact that the elasticity of the flexible driving shaft is utilised to increase the velocity of each blow. At the moment of impact, when the hammer is almost arrested, an automatic pawl comes into action and allows the shaft to wind up, with respect to the rotation of the hammer, so that the resilience of the shaft is utilised for the acceleration of the hammer beyond the rotational speed of the driving motor.—*January 24th*, 1929.

MISCELLANEOUS.

295,994. August 13th, 1928.—VALVES, Aktiengesellschaft Brown, Boveri & Cie., of Baden, Switzerland.

Valves for gases and liquids are frequently made in the form of double-seated valves for keeping the adjusting forces of the servo motors as small as possible. According to the invention, statically unbalanced forces are balanced by the reaction of the energy of velocity of the gases flowing through. The lower valve diameter A is smaller than the upper valve diameter B by the breadth of the seat. At the moment of opening, a closing force acts therefore downwardly on the valve, which must be overcome by the power piston. When the valve is slightly raised this force



disappears and unbalanced forces therefore remain which will cause oscillations. According to the invention, these unbalanced forces are balanced by the reaction of the energy of velocity on a deflecting ring provided for this purpose at the point C. At the commencement of the lift the difference in pressure of the gas in front of and behind the valve is at its greatest as is also, therefore, the downwardly acting force of the velocity energy. The unbalanced closing force and the balanced force of the velocity energy both disappear as the valve continues to lift, or at least change continuously. The velocity energy of the gas thus has a stabilising effect on the valve.—*February 7th*, 1929.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

FARADAY SOCIETY.—In the Rooms of the Chemical Society, Burlington House, Piccadilly, London, W. 1. Continuation of discussion on "Crystal Structure and Chemical Constitution," by Professor V. M. Goldschmidt. 2.30 p.m.

INSTITUTIONS OF CIVIL, MECHANICAL, AND ELECTRICAL ENGINEERS: GRADUATES' AND STUDENTS' SECTIONS, MIDLAND BRANCHES.—Grand Hotel, Birmingham. Annual joint meeting. Discussion, "A Hydro-electric Power Station." Civil, Mr. A. J. P. Pashler; Mechanical, Mr. S. W. B. Flavell; Electrical, Mr. P. E. Lyddon. 7 p.m.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate, St. James's Park, London, S.W. 1. "Research in Mechanical Engineering by Small-scale Apparatus," by Mr. F. C. Johansen. 6 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, S.W. 1. Informal meeting. "Locomotive Rating," by Mr. T. Grime. 7.30 p.m.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—Bolbec Hall, Newcastle-upon-Tyne. "Mechanical and Transmission Losses in Marine Engines, Shafting and Propellers," by Mr. J. Hamilton Gibson. 6 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, Piccadilly, London, W. 1. Discourse, "The Distribution of the Chemical Elements," by Professor V. M. Goldschmidt. 9 p.m.

SATURDAY, MARCH 16TH.

INSTITUTION OF CIVIL ENGINEERS.—Students' visit to the Fuel Research Station, East Greenwich.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS. South Midland District Meeting at Uxbridge, Middlesex. 10.30 a.m.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—South-Western District, Guildhall, Bath. Annual District Meeting. 11 a.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, Piccadilly, London, W. 1. "Molecular Motions in Rarefied Gases," by Sir Ernest Rutherford, F.R.S. 3 p.m.

MONDAY, MARCH 18TH.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate, St. James's Park, London, S.W. 1. Graduates' Section, London. "Locomotive Lubrication," by Mr. Keith Brinsmead. 6.30 p.m.

ROYAL AERONAUTICAL SOCIETY.—At the House of the Royal Society of Arts, 18, John-street, Adelphi, London, W.C. 2. "The Helicogyre," by Mr. V. Isacco. 6.30 p.m.

TUESDAY, MARCH 19TH.

ILLUMINATING ENGINEERING SOCIETY.—At the E.L.M.A. Lighting Service Bureau, 15, Savoy-street, Strand, W.C. 2. "Architectural Lighting," by Mr. Waldo Maitland. 6.30 p.m.

INSTITUTE OF METALS: BIRMINGHAM LOCAL SECTION.—The Engineers' Club, Waterloo-street, Birmingham. "Aluminium," by Dr. N. F. Budgen. 7 p.m.

INSTITUTE OF METALS: NORTH-EAST COAST LOCAL SECTION.—Electrical Engineering Lecture Theatre, Armstrong College, Newcastle-on-Tyne. Annual General Meeting and Exhibition of Metallurgical Preparations and Products. 7.30 p.m.

INSTITUTE OF TRANSPORT.—At the Institution of Electrical Engineers, Victoria Embankment, London, W.C. 2. Informal meeting. Discussion: "What Education Does a Transport Man Need?" introduced by Mr. Philip Burtt. 5.45 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Society of Motor Manufacturers and Traders, Ltd., 83, Pall Mall, S.W. 1. Inventors' evening. 7.45 p.m.

INSTITUTION OF CIVIL ENGINEERS.—Great George-street, Westminster, S.W. 1. Paper to be further discussed, "Impact in Railway Bridges, with Particular Reference to the Report of the Bridge Stress Committee," by Mr. Conrad Gribble. 6 p.m.

SOCIETE DES INGENIEURS CIVILS DE FRANCE.—In the Lecture Theatre of the Institution of Mechanical Engineers, Storey's-gate, Westminster, London, S.W. 1. "Evolution and Tendencies in the Coal Industry, Coal Washeries, and Modern Methods of Carbonisation," by M. C. Berthelot. 5.30 p.m.

WEDNESDAY, MARCH 20TH.

ROYAL METEOROLOGICAL SOCIETY.—49, Cromwell-road, South Kensington, London, S.W. 7. The G. J. Symons Memorial Lecture, "Weather and Wireless," by Mr. R. A. Watson Watt. 7.30 p.m.

ROYAL MICROSCOPICAL SOCIETY.—20, Hanover-square, London, W. 1. Discussion on Dr. H. Moore's paper on "The Mode of Formation of the Image in the Microscope." 7.30 p.m.

ROYAL SOCIETY OF ARTS.—John-street, Adelphi, London, W.C. 2. "Modern English Architecture," by Professor A. E. Richardson, F.R.S. 8 p.m.

SOCIETY OF GLASS TECHNOLOGY.—In the Coal, Gas and Fuel Industries Department, the University, Leeds. General meeting. "The Distribution of Temperature in Glass Tank Furnaces," by Mr. E. A. Coad-Pryor; "The Selection of Coal for Gas Producers," by Mr. E. J. C. Bowmaker and Mr. J. D. Cauwood. 2.30 p.m.

THURSDAY, MARCH 21ST.

INSTITUTION OF AUTOMOBILE ENGINEERS: WESTERN CENTRE.—Technical School, Gloucester. "The Inspection of Metals and their Alloys," by Mr. L. W. Johnson. 7.30 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS.—In the Lecture Theatre of the Institution, Savoy-place, Victoria Embankment, W.C. 2. "Direct Generation of Alternating Current at High Voltages," by the Hon. Sir Charles A. Parsons, F.R.S., and Mr. J. Rosen; and "Recent Developments in Turbo-generators," by Mr. J. A. Kuyser. Preceded at 5.30 p.m. by a demonstration in the Common Room of a portable electric harmonic analyser, by Mr. R. T. Coe. 6 p.m.

FRIDAY, MARCH 22ND.

INSTITUTION OF CIVIL ENGINEERS: BIRMINGHAM AND DISTRICT ASSOCIATION.—Chamber of Commerce, New-street, Birmingham. "The Development of the Generation and Distribution of Electricity in the British Isles," by Mr. Archibald Page. 6 p.m.

INSTITUTION OF LOCOMOTIVE ENGINEERS: NORTH-EASTERN CENTRE.—Hotel Metropole, Leeds. "Experiments on Buffer Springs," by Mr. T. Robson. 7 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—At 39, Victoria-street, S.W. 1. Informal meeting. "Ventilation," by Mr. D. A. Collin. Slides and demonstrations. 7.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, Piccadilly, London, W. 1. Discourse, "Penetrating Radiations," by Sir Ernest Rutherford, F.R.S. 9 p.m.

SATURDAY, MARCH 23RD.

CHELSEA POLYTECHNIC.—Manresa-road, London, S.W. 3. Conversazione. 3 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, Piccadilly, London, W. 1. "Molecular Motions in Rarefied Gases," Lecture IV., by Sir Ernest Rutherford, F.R.S. 3 p.m.

MONDAY, MARCH 25TH.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate, St. James's Park, S.W. 1. Graduates Annual Lecture, "Aircraft Engineering in its Relation to Mechanical Engineering," by Wing-Commander T. R. Cave-Browne-Cave. 6.30 p.m.

WEDNESDAY, MARCH 27TH.

INSTITUTION OF CIVIL ENGINEERS.—Great George-street, Westminster, S.W. 1. Students' meeting. Informal discussion on "Roads," by Mr. Donald Hamish Little. 6.30 p.m.

NEWCOMEN SOCIETY.—In Prince Henry's Room, 17, Fleet-street, E.C. 4. "John Wyatt, and the Weighing of Heavy Loads," by Mr. W. A. Benton. 5.30 p.m.

SATURDAY, APRIL 6TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS: YORKSHIRE DISTRICT.—Town Hall, Leeds. Resumed discussion on the address by Mr. W. J. Hadfield on "The Local Government Bill and the Municipal Engineer, with Particular Reference to the Compensation Clauses." 2.30 p.m.

WEDNESDAY, APRIL 10TH.

INSTITUTION OF MINING AND METALLURGY.—Hotel Cecil (Victoria Hall). Annual dinner. 7.45 p.m.

MONDAY, APRIL 15TH.

INSTITUTION OF ELECTRICAL ENGINEERS.—Savoy-place, Victoria Embankment, W.C. 2. Informal meeting. Discussion on "Power Supply and Railway Electrical Signalling," to be opened by Mr. M. G. Tweedie. 7 p.m.

THE INSTITUTION OF ELECTRICAL ENGINEERS.—At an informal meeting of the Institution of Electrical Engineers, held on Monday, March 4th, Mr. L. J. Hunt opened a discussion on "Variable Speed A.C. Motors." He dealt with the various methods of speed variation by grouping the motors under the three standard types, pole-change, cascade, and commutator, all depending upon the development of the additional counter E.M.F. He also exhibited a number of lantern slides showing the motors and diagrams of their windings and performances. Most of the motors he described are now well known, and Mr. Hunt's remarks were mainly directed to the application of each type to its particular problem. The Scherbius method, he explained, was an excellent solution of the problem, but the number of machines involved serious complications and, except for some requirements, a better solution was a single Schrage motor. The latter was, however, very expensive, and he thought the all-round advantages were with the cascade method, which was simple and robust, while the speed could be changed by switching the connections on the slip rings without opening the stator circuit. Mr. W. A. Erlebach drew a very simple diagram plotting the E.M.F. and counter E.M.F. functioning on change of speed. Mr. F. V. Schulthess described a new system of Scherbius regulation with a double rotor which seemed to be a development of the Spinner motor. It was a commutator motor with voltage regulation producing variable speed and power factor correction. Mr. J. H. Johnson said that if the user could manage with a pole-change he would be well advised to do so. The commutator motor had limitations of size and was expensive in cost and upkeep. He thought that the advantages were often with a motor generator in spite of the space factor. Mr. A. F. Harmer said that the reason why the cost of variable speed machines was large was because the demand was so small. He believed the future would show a more extended use of single-phase current than was generally anticipated. Messrs. H. D. Barlow, J. R. Bedford, G. B. Bryan, B. M. Burt, A. N. D. Kerr, C. D. King, N. Prentice, E. S. Ritter, D. M. Robinson, L. E. Squire, E. O. Taylor and W. L. Wreford also spoke.